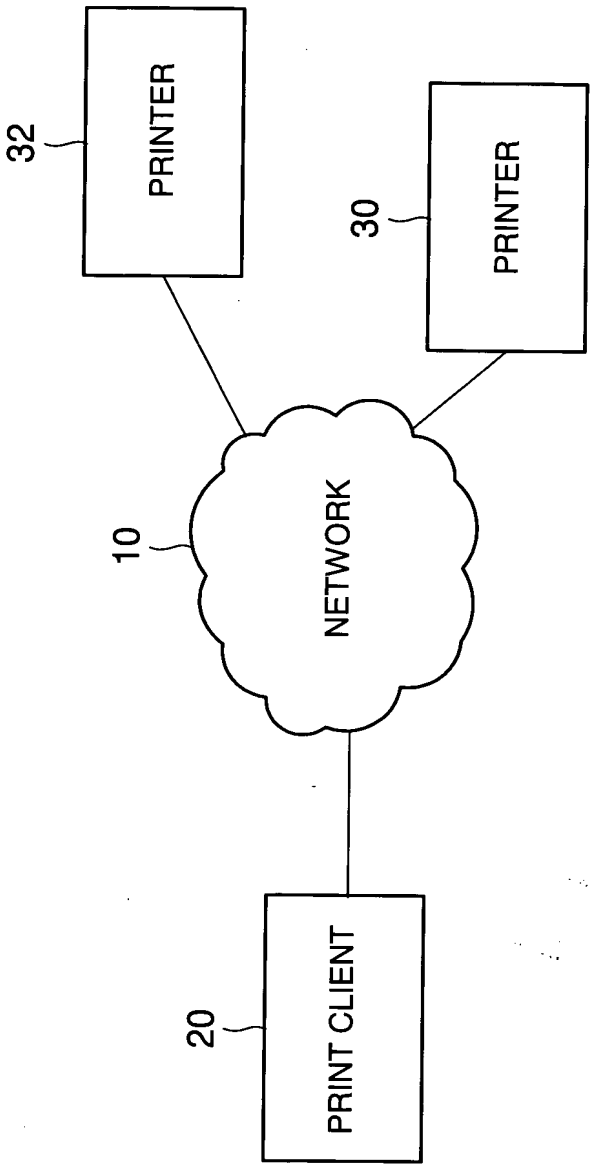

FIG. 1

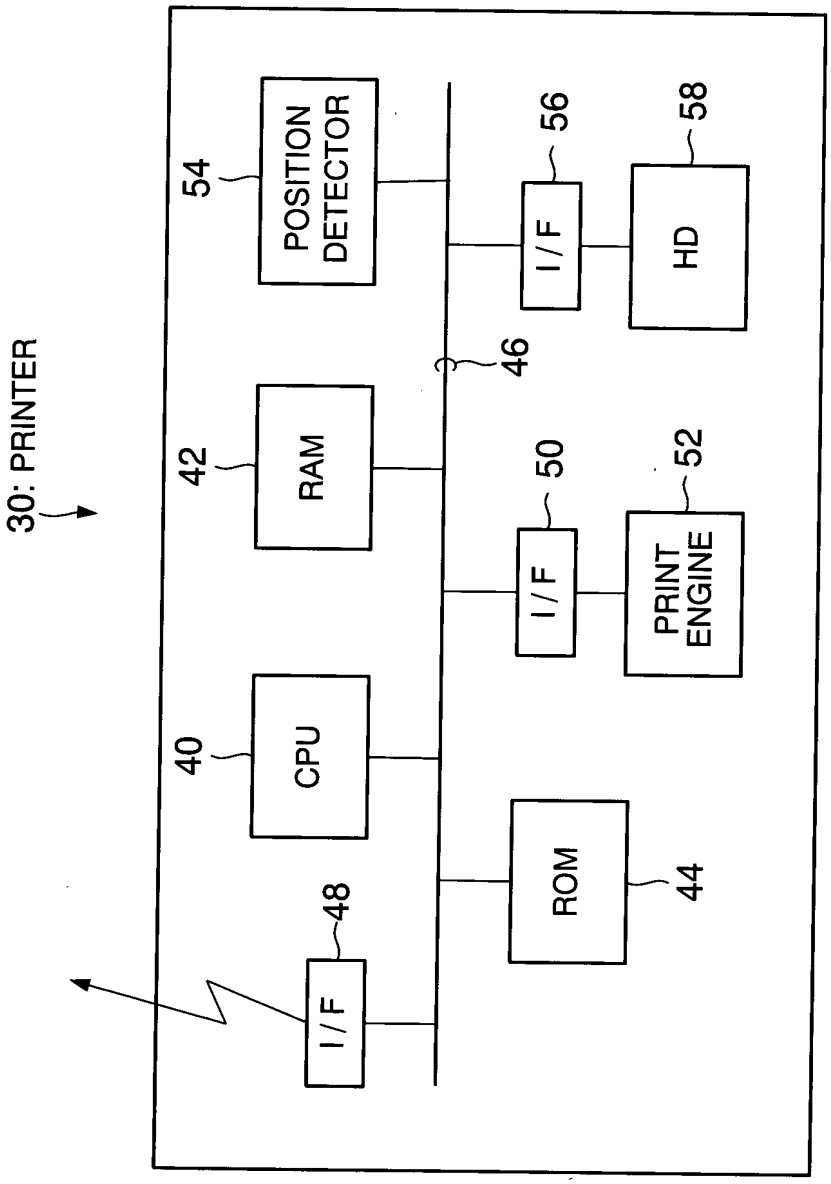
30: PRINTER
POSITION DETECTOR
54
56
58
I / F
HD
46
RAM
42
50
52
I / F
PRINT ENGINE
CPU
40
ROM
44
48
I / F

FIG. 2

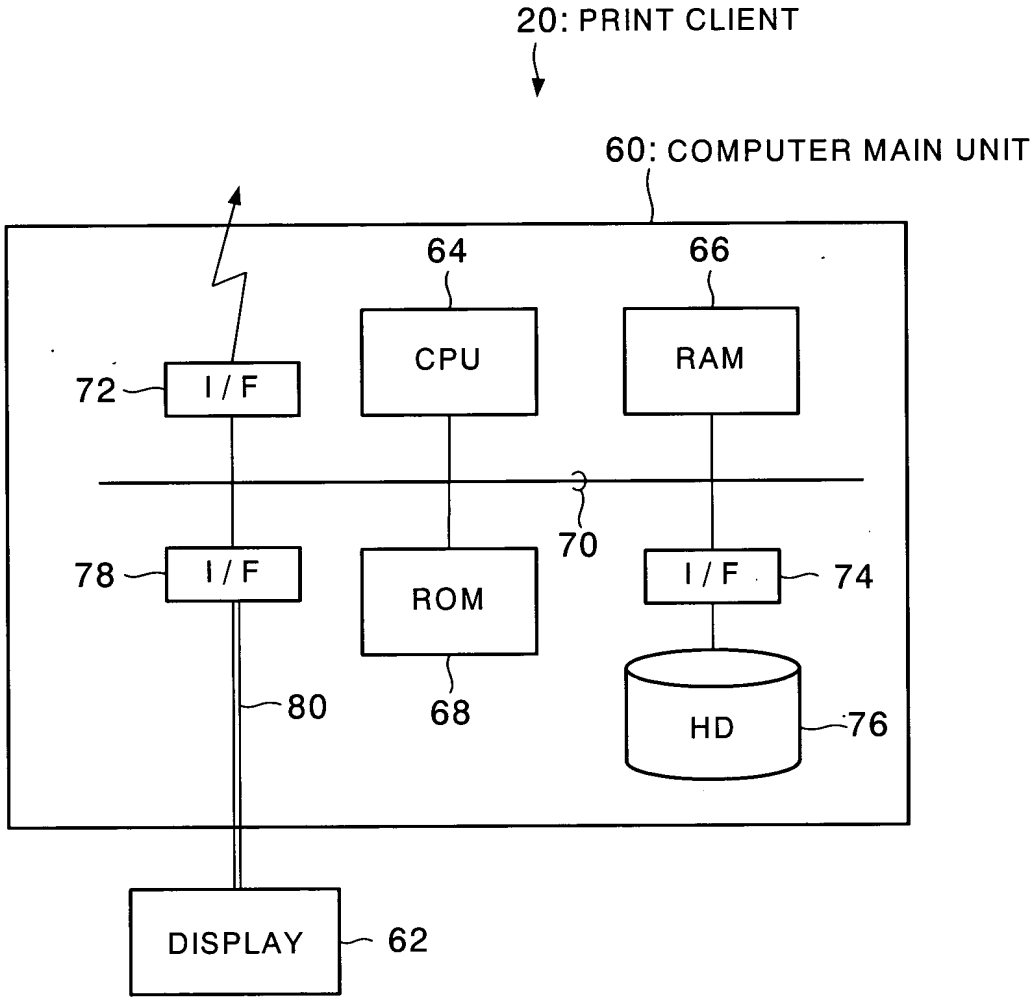
20: PRINT CLIENT
60: COMPUTER MAIN UNIT
64
66
CPU
RAM
72
I / F
70
78
I / F
ROM
I / F
74
80
68
HD
76
DISPLAY
62

FIG. 3

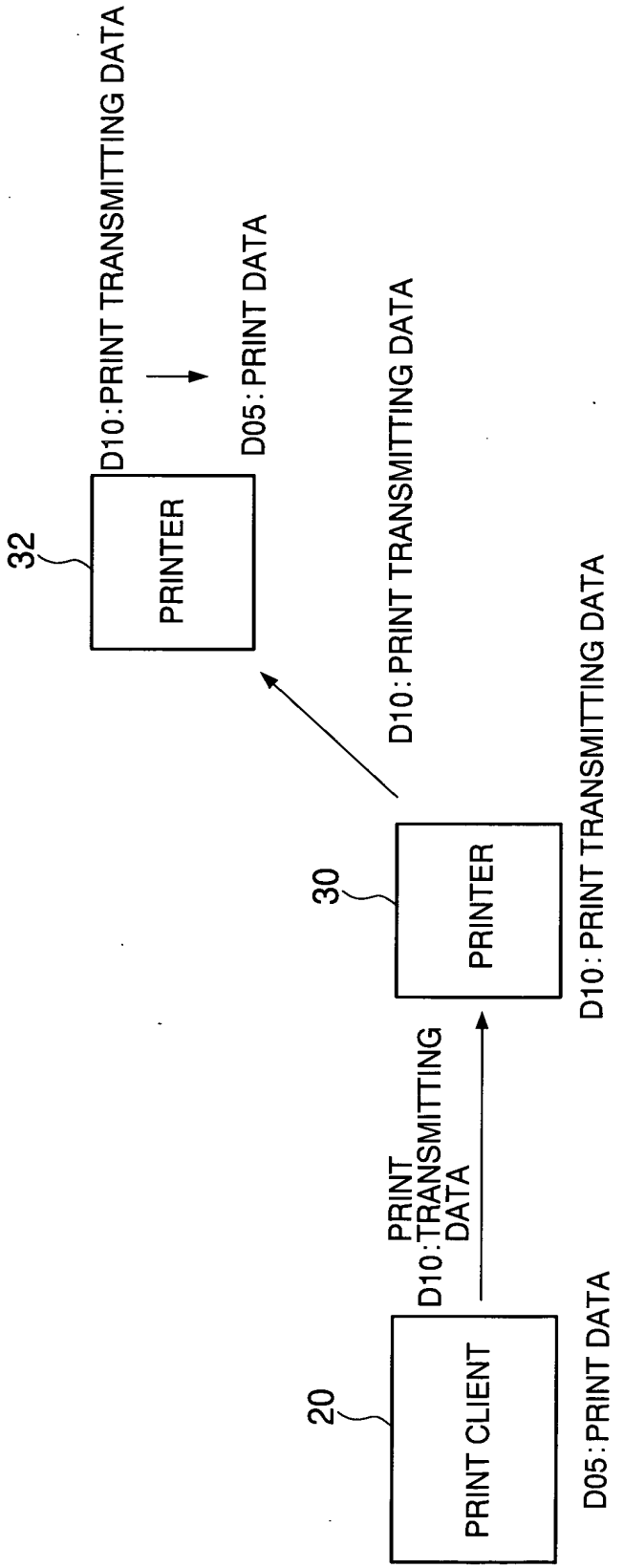
20
PRINT CLIENT
PRINT D10:TRANSMITTING DATA
D05:PRINT DATA
D10:PRINT TRANSMITTING DATA
30
PRINTER
D10:PRINT TRANSMITTING DATA
D05:PRINT DATA
D10:PRINT TRANSMITTING DATA
32
PRINTER
D10:PRINT TRANSMITTING DATA
D05:PRINT DATA

FIG. 4

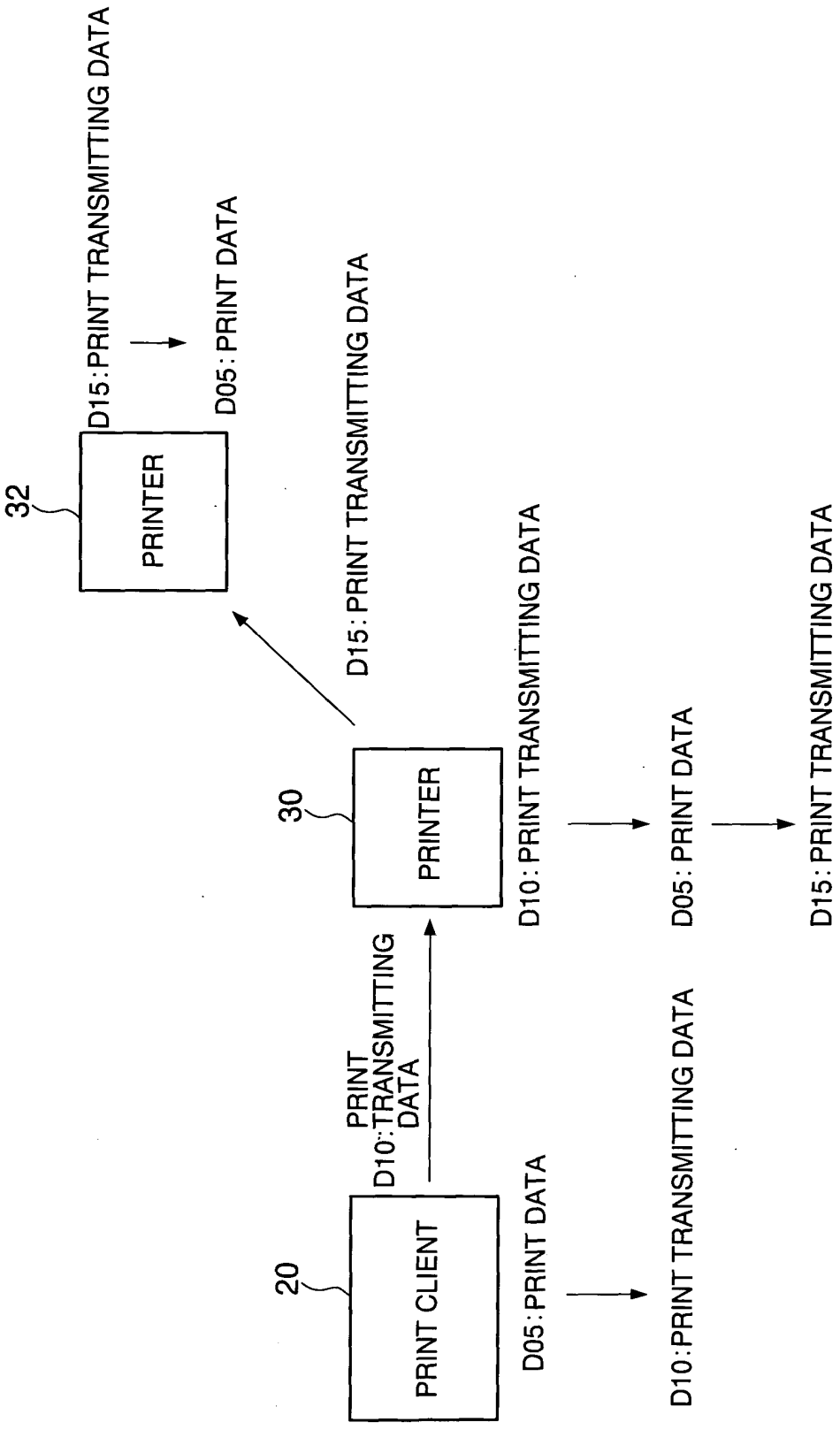
20
PRINT CLIENT
PRINT D10:TRANSMITTING DATA
30
PRINTER
32
PRINTER
D05:PRINT DATA
D10:PRINT TRANSMITTING DATA
D15:PRINT TRANSMITTING DATA
D05:PRINT DATA
D10:PRINT TRANSMITTING DATA
D05:PRINT DATA
D15:PRINT TRANSMITTING DATA
D15:PRINT TRANSMITTING DATA

FIG. 5

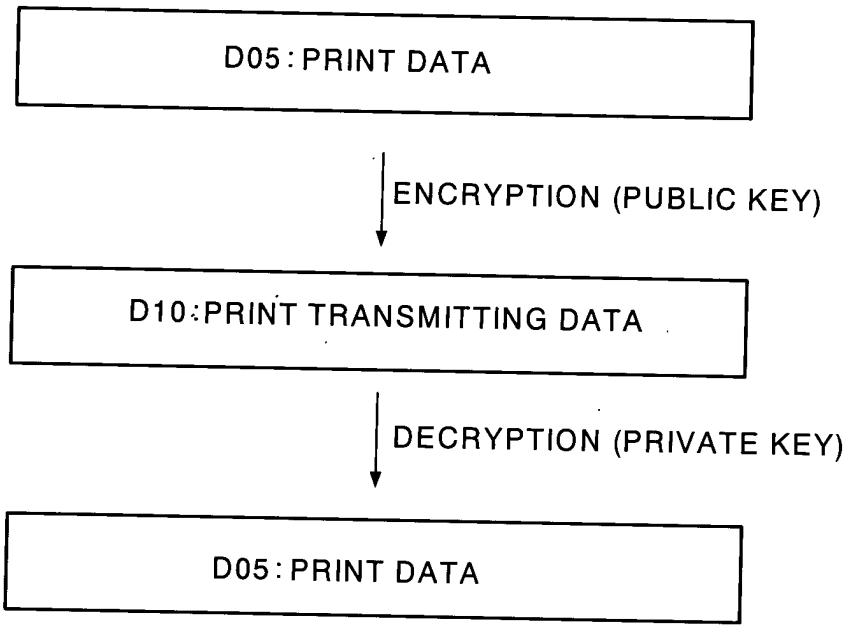
D05 : PRINT DATA
ENCRYPTION (PUBLIC KEY)
D10 : PRINT TRANSMITTING DATA
DECRYPTION (PRIVATE KEY)
D05 : PRINT DATA

FIG. 6

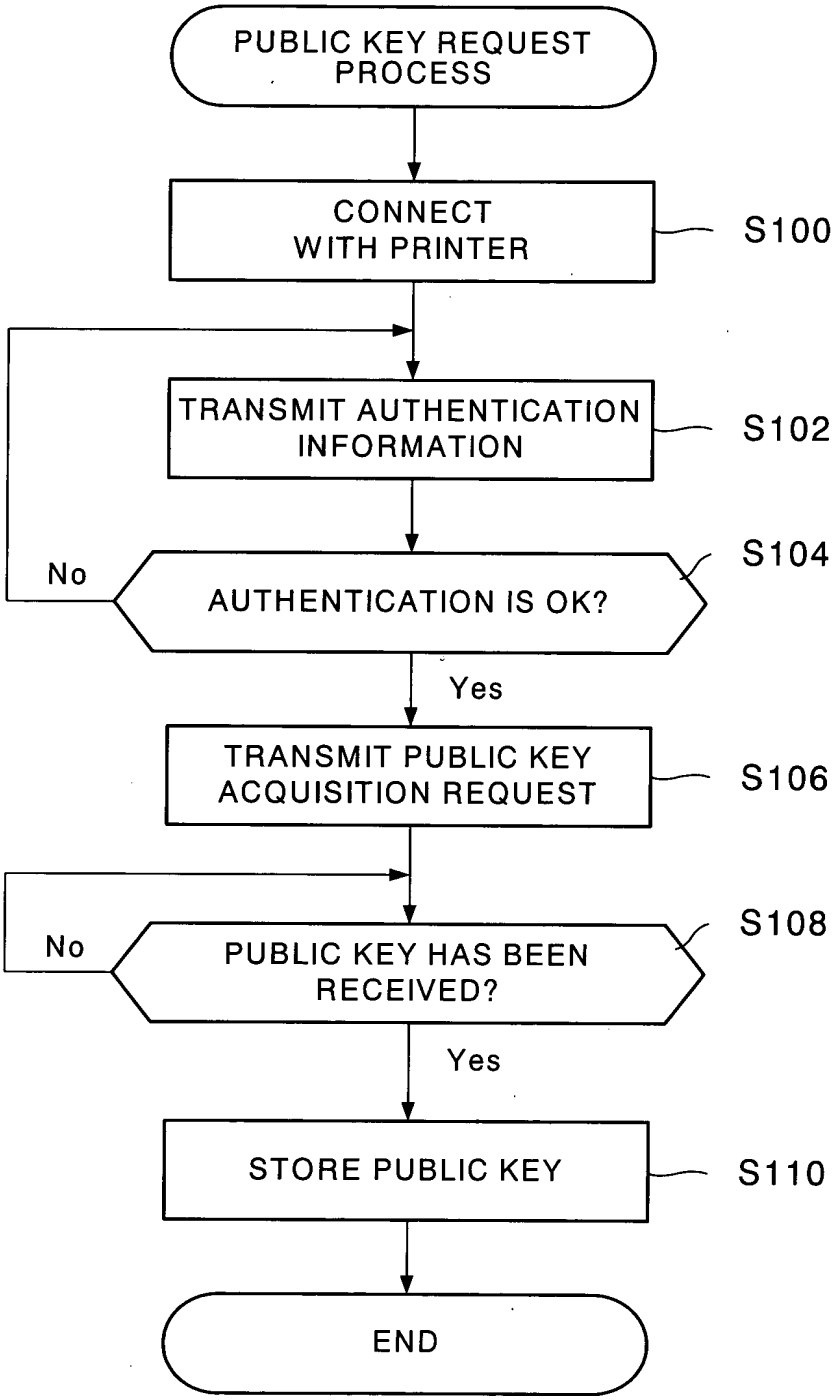
PUBLIC KEY REQUEST PROCESS
CONNECT WITH PRINTER
S100
TRANSMIT AUTHENTICATION INFORMATION
S102
No
AUTHENTICATION IS OK?
S104
Yes
TRANSMIT PUBLIC KEY ACQUISITION REQUEST
S106
No
PUBLIC KEY HAS BEEN RECEIVED?
S108
Yes
STORE PUBLIC KEY
S110
END

FIG. 7

TB20: PUBLIC KEY TABLE

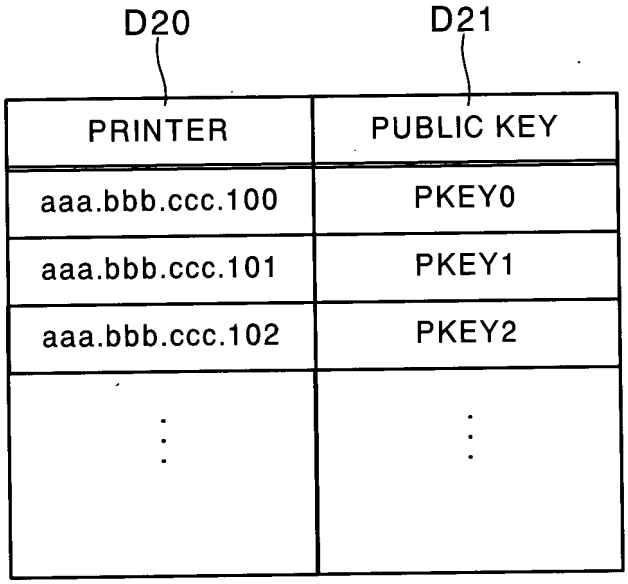

FIG. 8

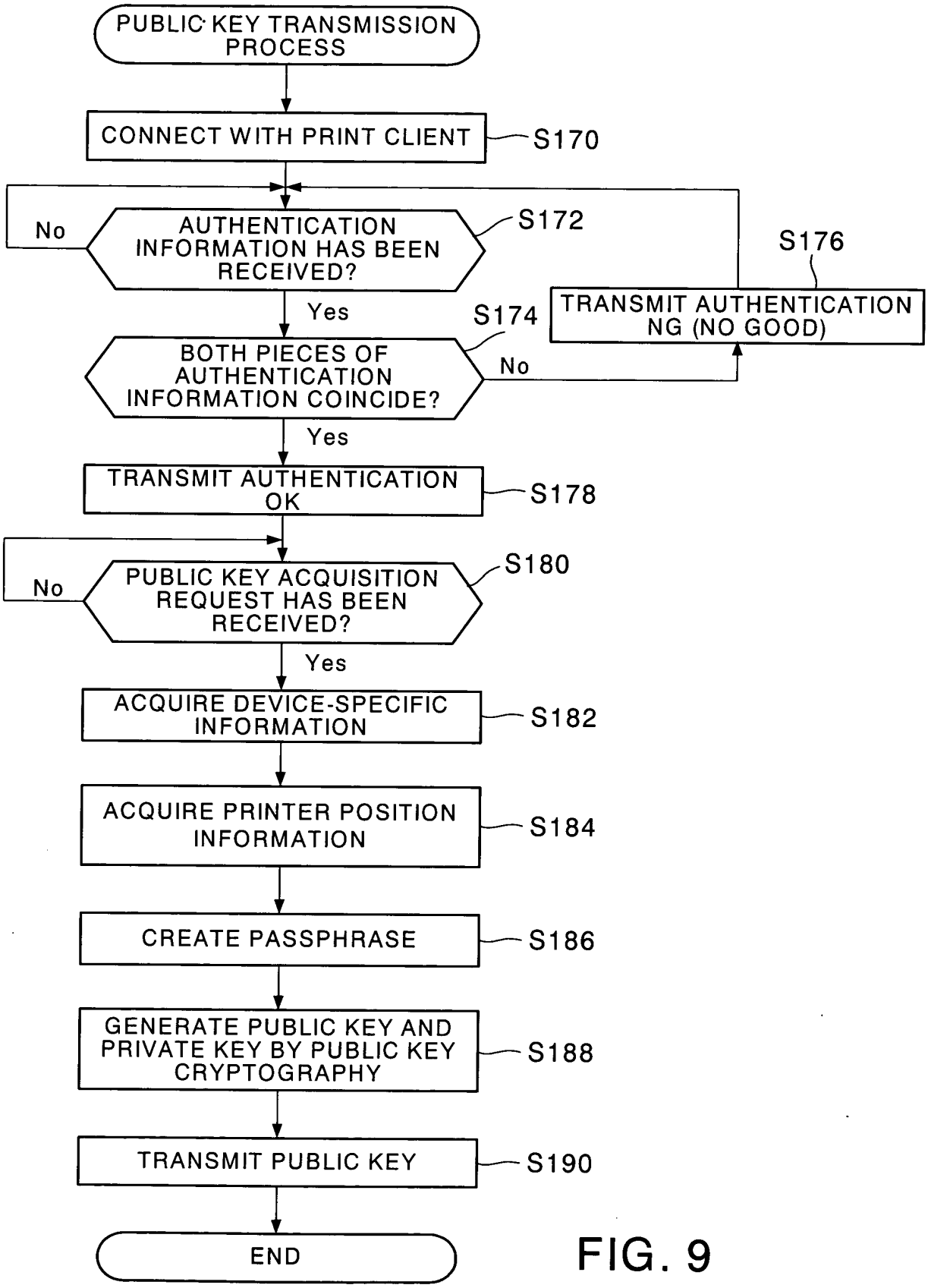
PUBLIC KEY TRANSMISSION PROCESS
CONNECT WITH PRINT CLIENT
S170
No
AUTHENTICATION INFORMATION HAS BEEN RECEIVED?
S172
Yes
BOTH PIECES OF AUTHENTICATION INFORMATION COINCIDE?
S174
No
TRANSMIT AUTHENTICATION NG (NO GOOD)
S176
Yes
TRANSMIT AUTHENTICATION OK
S178
No
PUBLIC KEY ACQUISITION REQUEST HAS BEEN RECEIVED?
S180
Yes
ACQUIRE DEVICE-SPECIFIC INFORMATION
S182
ACQUIRE PRINTER POSITION INFORMATION
S184
CREATE PASSPHRASE
S186
GENERATE PUBLIC KEY AND PRIVATE KEY BY PUBLIC KEY CRYPTOGRAPHY
S188
TRANSMIT PUBLIC KEY
S190
END

FIG. 9

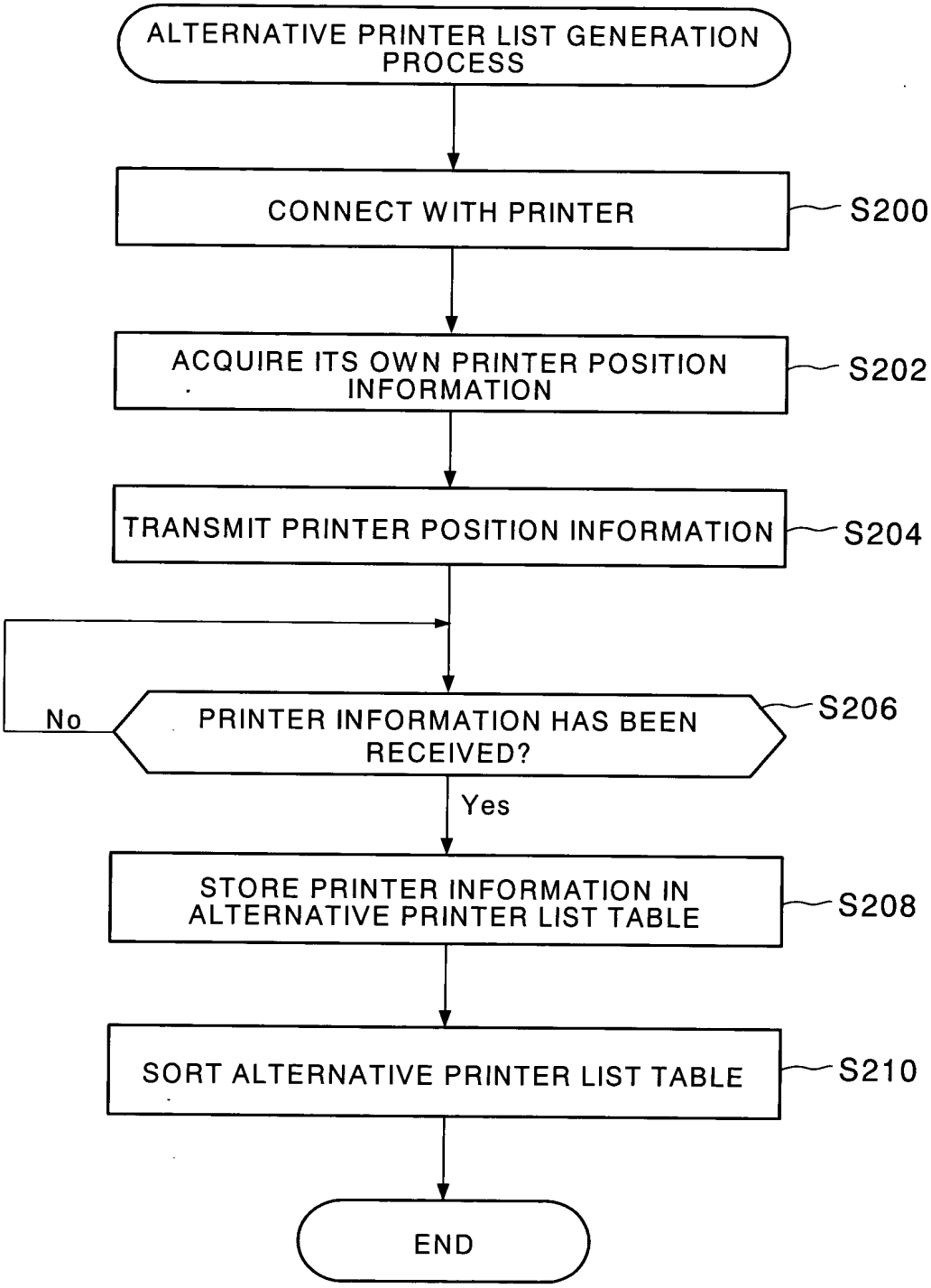
ALTERNATIVE PRINTER LIST GENERATION PROCESS
CONNECT WITH PRINTER
S200
ACQUIRE ITS OWN PRINTER POSITION INFORMATION
S202
TRANSMIT PRINTER POSITION INFORMATION
S204
No
PRINTER INFORMATION HAS BEEN RECEIVED?
S206
Yes
STORE PRINTER INFORMATION IN ALTERNATIVE PRINTER LIST TABLE
S208
SORT ALTERNATIVE PRINTER LIST TABLE
S210
END

FIG. 10

TB40: ALTERNATIVE PRINTER LIST TABLE

D40 NETWORK ADDRESS	D41 PRINTER MODEL INFORMATION	D42 RELATIVE DISTANCE	D43 PUBLIC KEY
aaa.bbb.ccc.101	LP-7700	ΔX1, ΔY1, ΔZ1	PKEY1
aaa.bbb.ccc.102	LP-8900	ΔX2, ΔY2, ΔZ2	PKEY2
aaa.bbb.ccc.103	LP-7700	ΔX3, ΔY3, ΔZ3	PKEY3

FIG. 11

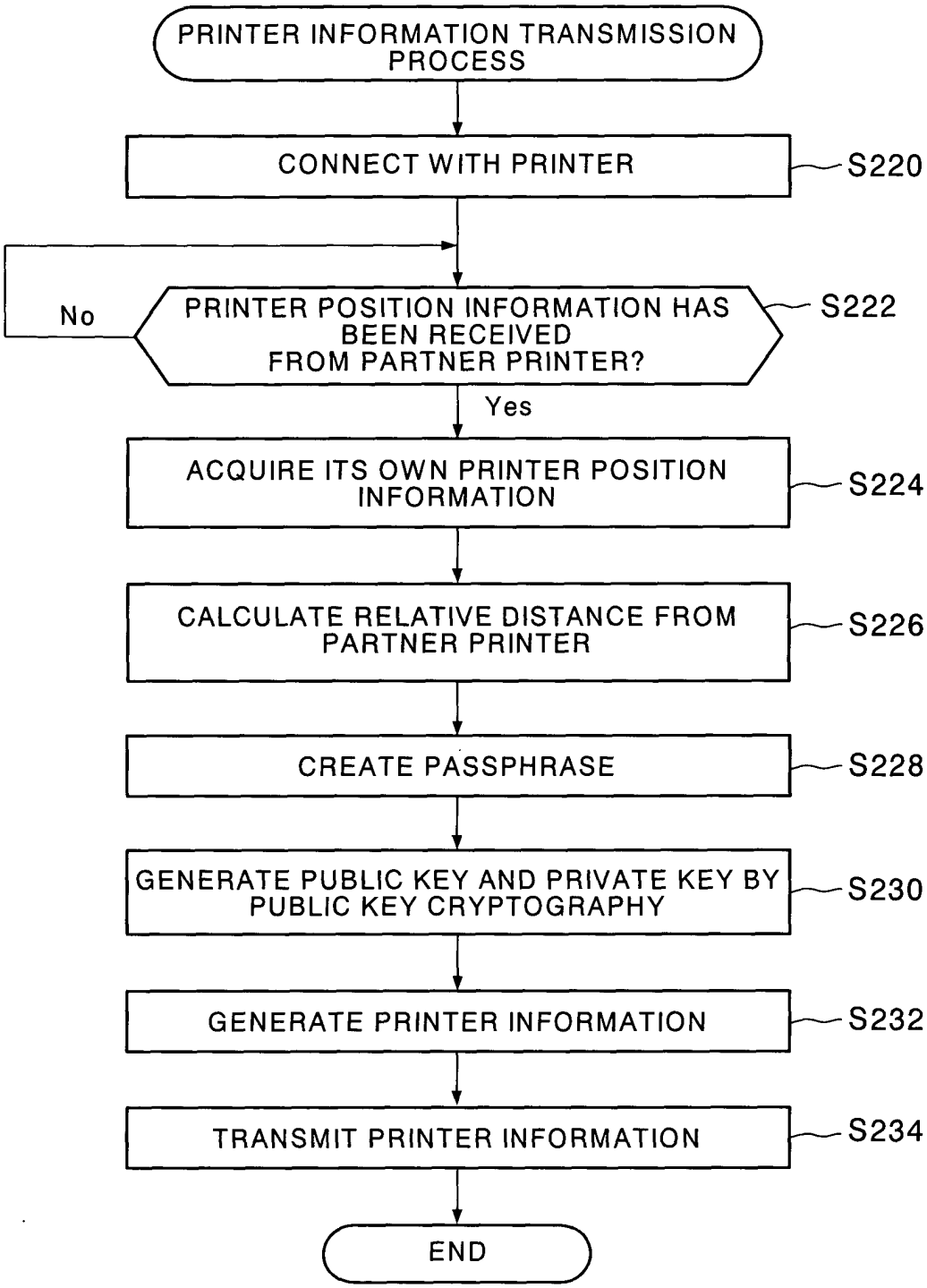
PRINTER INFORMATION TRANSMISSION PROCESS
CONNECT WITH PRINTER
S220
No
PRINTER POSITION INFORMATION HAS BEEN RECEIVED FROM PARTNER PRINTER?
S222
Yes
ACQUIRE ITS OWN PRINTER POSITION INFORMATION
S224
CALCULATE RELATIVE DISTANCE FROM PARTNER PRINTER
S226
CREATE PASSPHRASE
S228
GENERATE PUBLIC KEY AND PRIVATE KEY BY PUBLIC KEY CRYPTOGRAPHY
S230
GENERATE PRINTER INFORMATION
S232
TRANSMIT PRINTER INFORMATION
S234
END

FIG. 12

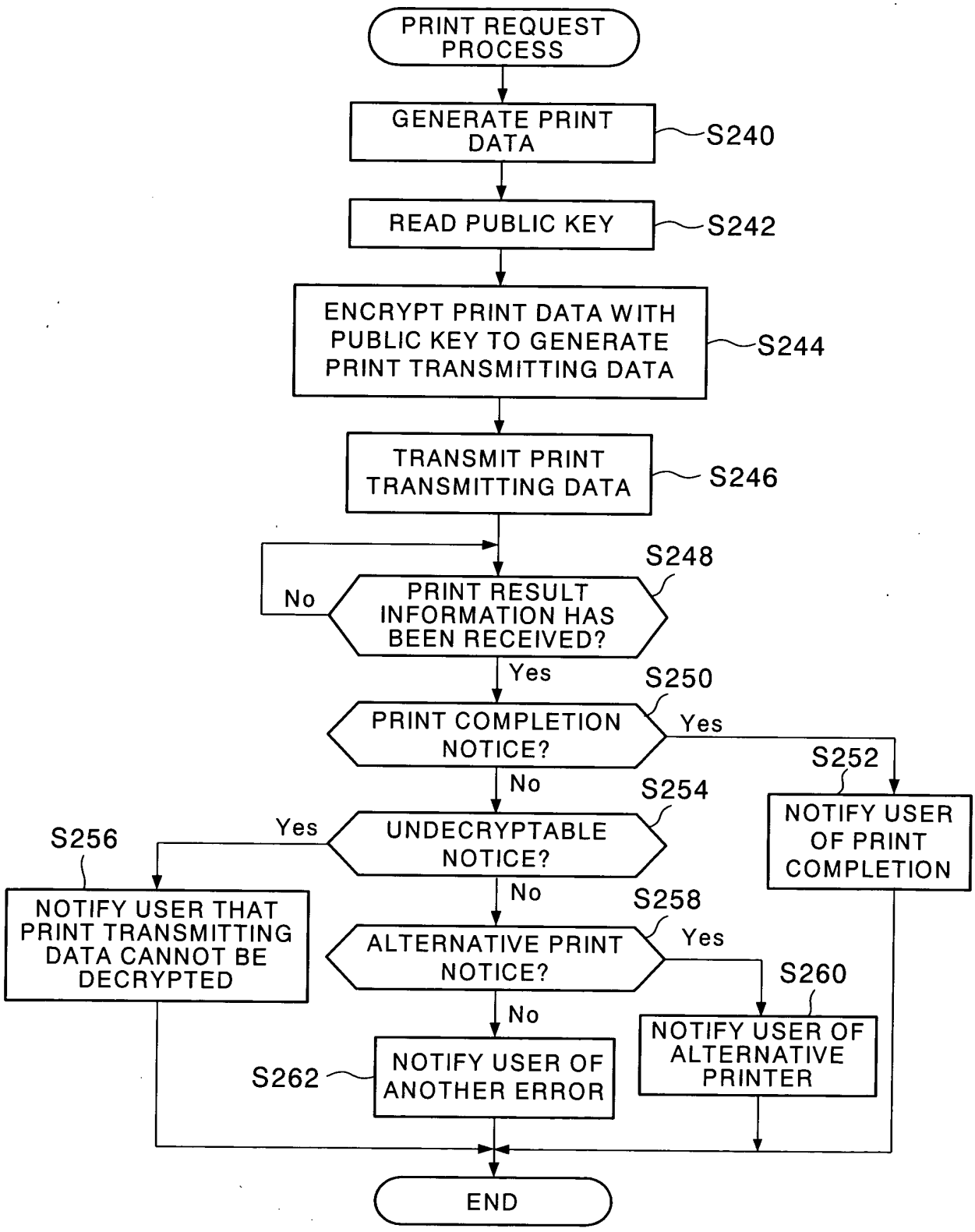
PRINT REQUEST PROCESS
GENERATE PRINT DATA
S240
READ PUBLIC KEY
S242
ENCRYPT PRINT DATA WITH PUBLIC KEY TO GENERATE PRINT TRANSMITTING DATA
S244
TRANSMIT PRINT TRANSMITTING DATA
S246
S248
No
PRINT RESULT INFORMATION HAS BEEN RECEIVED?
Yes
S250
PRINT COMPLETION NOTICE?
Yes
S252
NOTIFY USER OF PRINT COMPLETION
No
S254
UNDECRYPTABLE NOTICE?
Yes
S256
NOTIFY USER THAT PRINT TRANSMITTING DATA CANNOT BE DECRYPTED
No
S258
ALTERNATIVE PRINT NOTICE?
Yes
S260
NOTIFY USER OF ALTERNATIVE PRINTER
No
S262
NOTIFY USER OF ANOTHER ERROR
END

FIG. 13

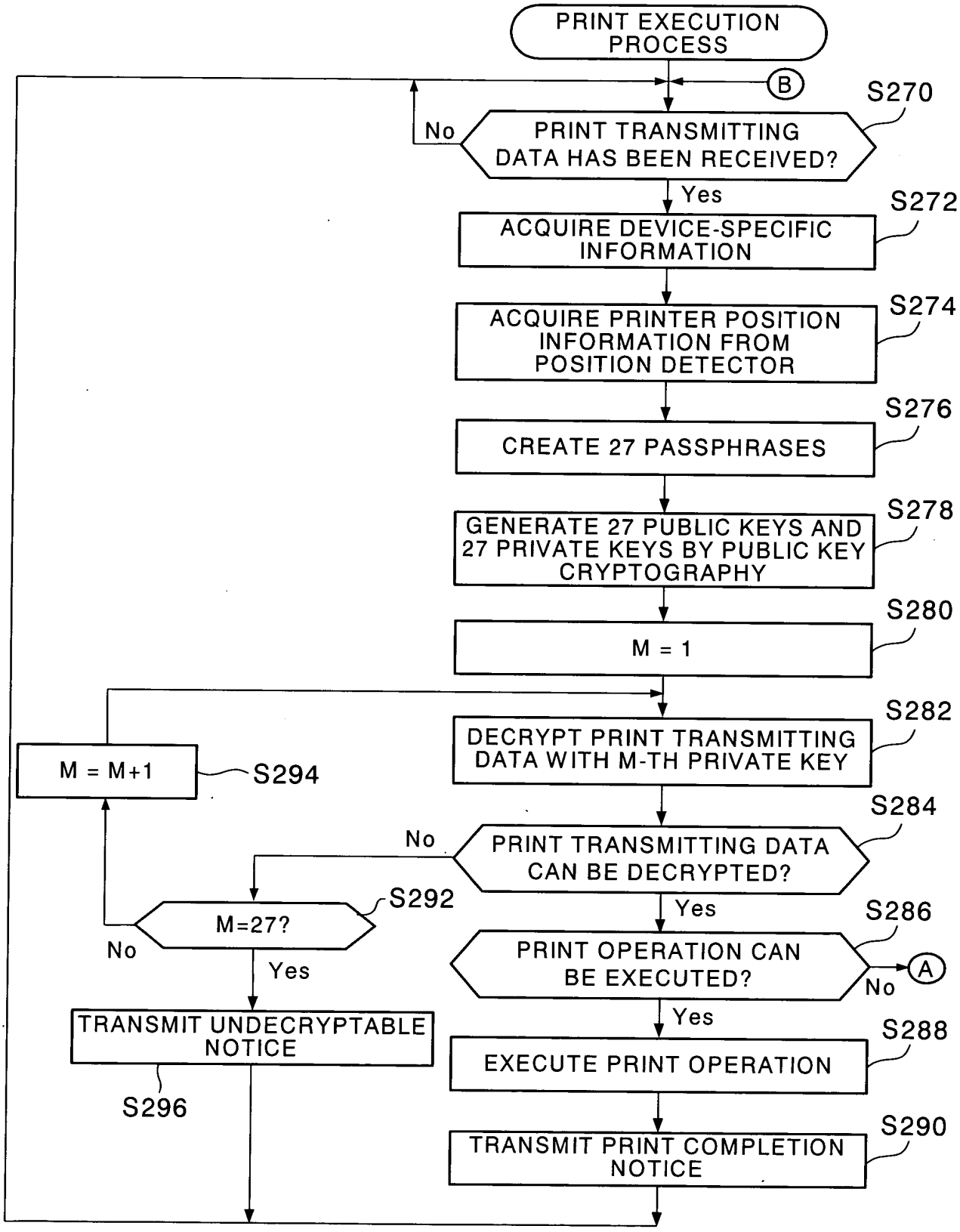
PRINT EXECUTION PROCESS
B
S270
No
PRINT TRANSMITTING DATA HAS BEEN RECEIVED?
Yes
S272
ACQUIRE DEVICE-SPECIFIC INFORMATION
S274
ACQUIRE PRINTER POSITION INFORMATION FROM POSITION DETECTOR
S276
CREATE 27 PASSPHRASES
S278
GENERATE 27 PUBLIC KEYS AND 27 PRIVATE KEYS BY PUBLIC KEY CRYPTOGRAPHY
S280
M = 1
S282
DECRYPT PRINT TRANSMITTING DATA WITH M-TH PRIVATE KEY
S284
No
PRINT TRANSMITTING DATA CAN BE DECRYPTED?
Yes
S286
PRINT OPERATION CAN BE EXECUTED?
No
A
Yes
S288
EXECUTE PRINT OPERATION
S290
TRANSMIT PRINT COMPLETION NOTICE
S292
M=27?
No
Yes
S294
M = M+1
TRANSMIT UNDECRYPTABLE NOTICE
S296

FIG. 14

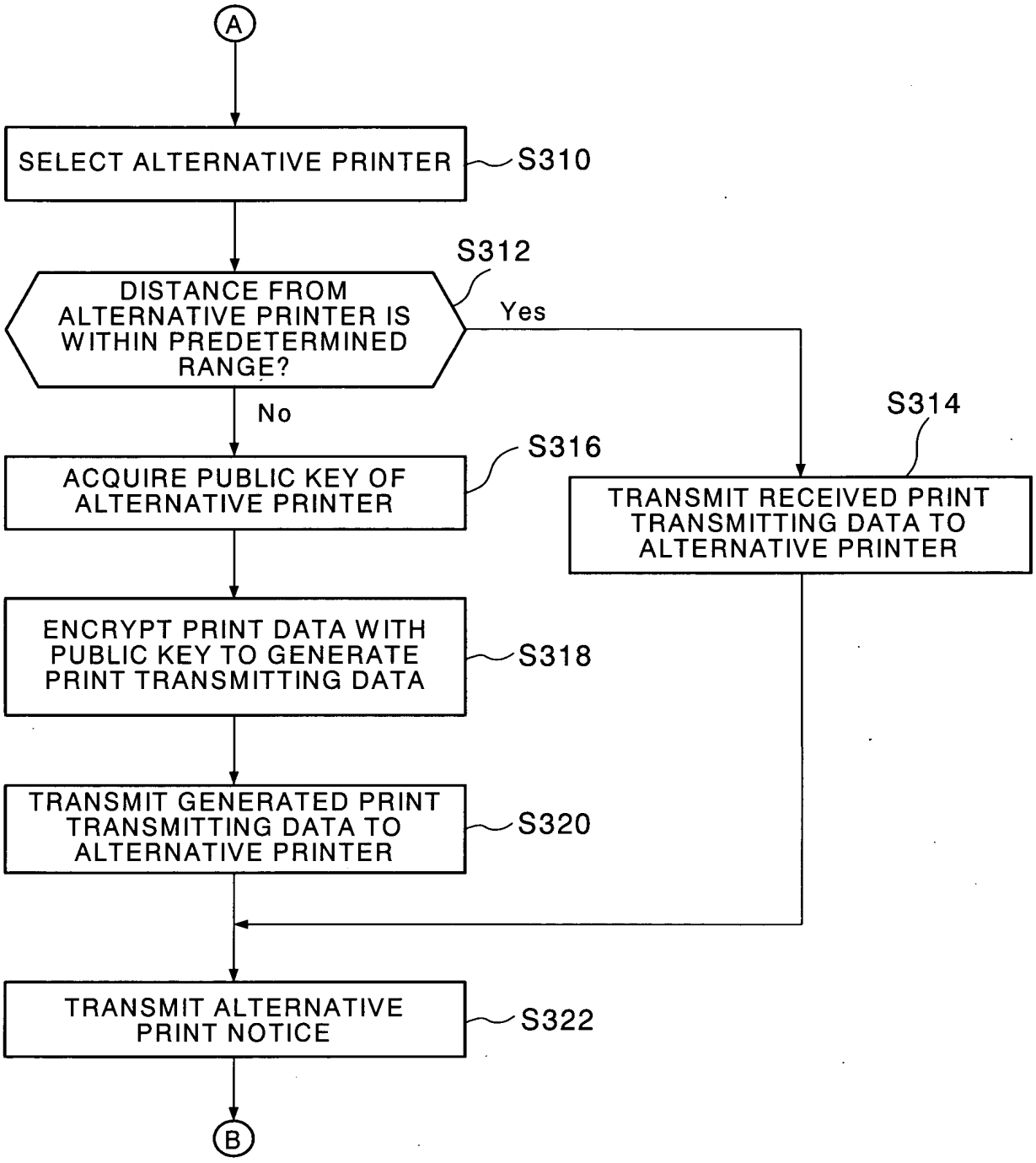
A
SELECT ALTERNATIVE PRINTER
S310
S312
DISTANCE FROM ALTERNATIVE PRINTER IS WITHIN PREDETERMINED RANGE?
Yes
No
S314
TRANSMIT RECEIVED PRINT TRANSMITTING DATA TO ALTERNATIVE PRINTER
S316
ACQUIRE PUBLIC KEY OF ALTERNATIVE PRINTER
ENCRYPT PRINT DATA WITH PUBLIC KEY TO GENERATE PRINT TRANSMITTING DATA
S318
TRANSMIT GENERATED PRINT TRANSMITTING DATA TO ALTERNATIVE PRINTER
S320
TRANSMIT ALTERNATIVE PRINT NOTICE
S322
B

FIG. 15

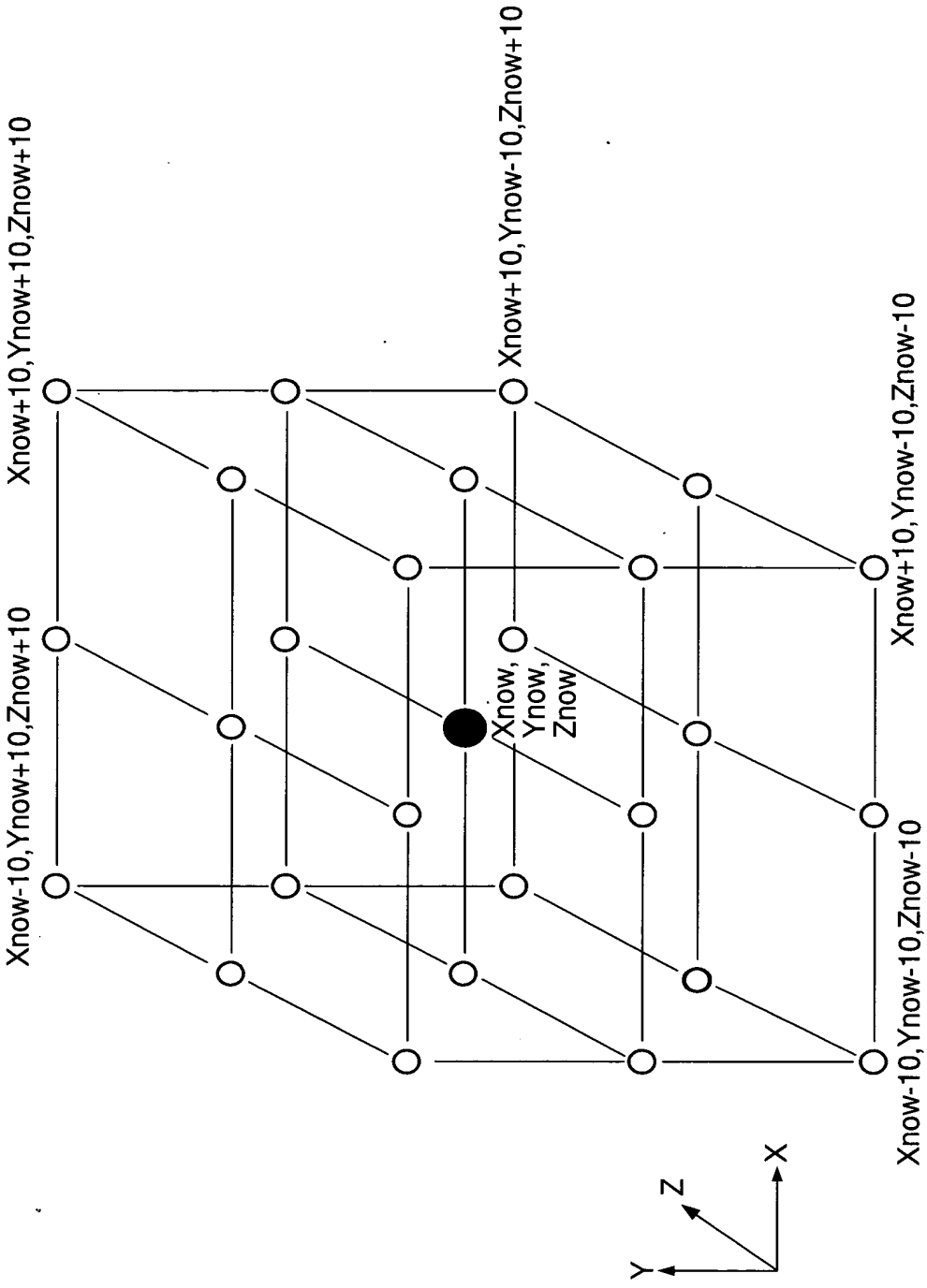
Xnow+10,Ynow+10,Znow+10
Xnow+10,Ynow-10,Znow+10
Xnow-10,Ynow+10,Znow+10
Xnow, Ynow, Znow
Xnow+10,Ynow-10,Znow-10
Xnow-10,Ynow-10,Znow-10
Z
X
Y

FIG. 16

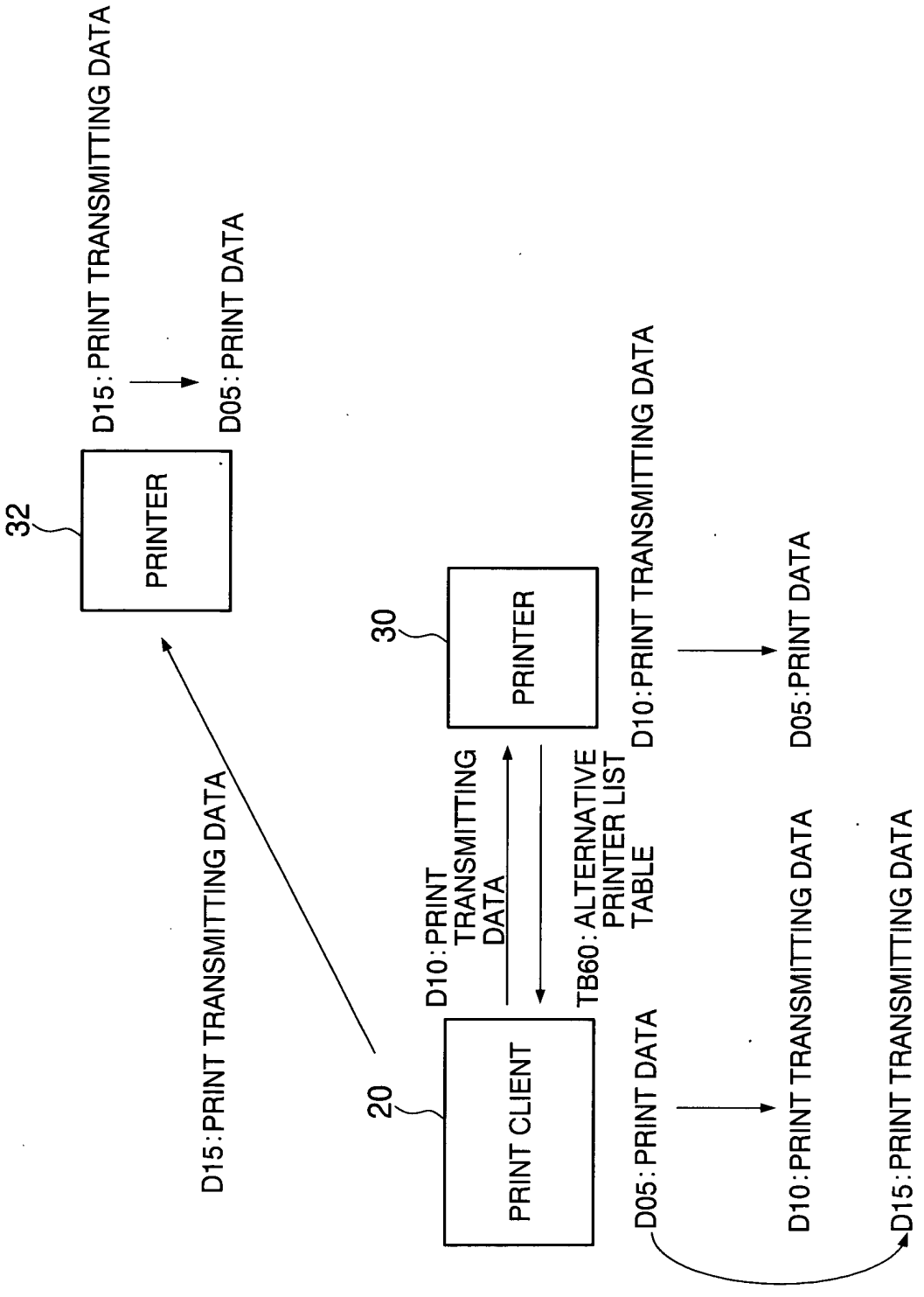
32
PRINTER
D15: PRINT TRANSMITTING DATA
D05: PRINT DATA
D15: PRINT TRANSMITTING DATA
20
PRINT CLIENT
D10: PRINT TRANSMITTING DATA
TB60: ALTERNATIVE PRINTER LIST TABLE
30
PRINTER
D10: PRINT TRANSMITTING DATA
D05: PRINT DATA
D05: PRINT DATA
D10: PRINT TRANSMITTING DATA
D15: PRINT TRANSMITTING DATA

FIG. 17

TB60 : ALTERNATIVE PRINTER LIST TABLE

D40 NETWORK ADDRESS	D41 PRINTER MODEL INFORMATION	D42 RELATIVE DISTANCE
aaa.bbb.ccc.101	LP-7700	ΔX1, ΔY1, ΔZ1
aaa.bbb.ccc.102	LP-8900	ΔX2, ΔY2, ΔZ2
aaa.bbb.ccc.103	LP-7700	ΔX3, ΔY3, ΔZ3

FIG. 18

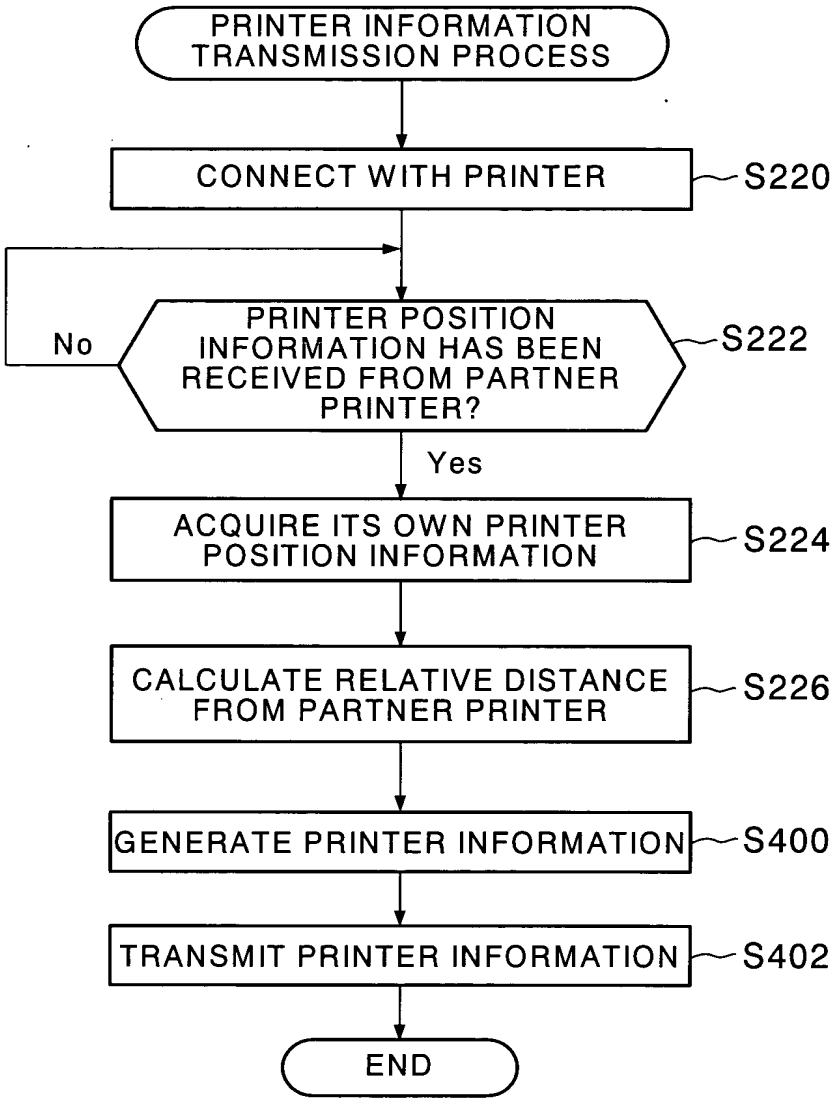
PRINTER INFORMATION TRANSMISSION PROCESS
CONNECT WITH PRINTER
S220
No
PRINTER POSITION INFORMATION HAS BEEN RECEIVED FROM PARTNER PRINTER?
S222
Yes
ACQUIRE ITS OWN PRINTER POSITION INFORMATION
S224
CALCULATE RELATIVE DISTANCE FROM PARTNER PRINTER
S226
GENERATE PRINTER INFORMATION
S400
TRANSMIT PRINTER INFORMATION
S402
END

FIG. 19

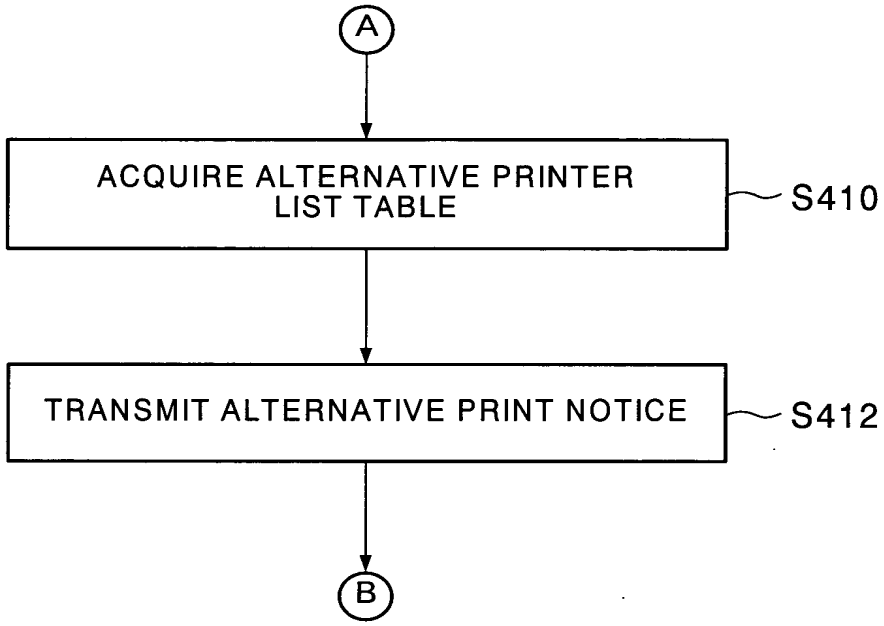
A
ACQUIRE ALTERNATIVE PRINTER LIST TABLE
S410
TRANSMIT ALTERNATIVE PRINT NOTICE
S412
B

FIG. 20

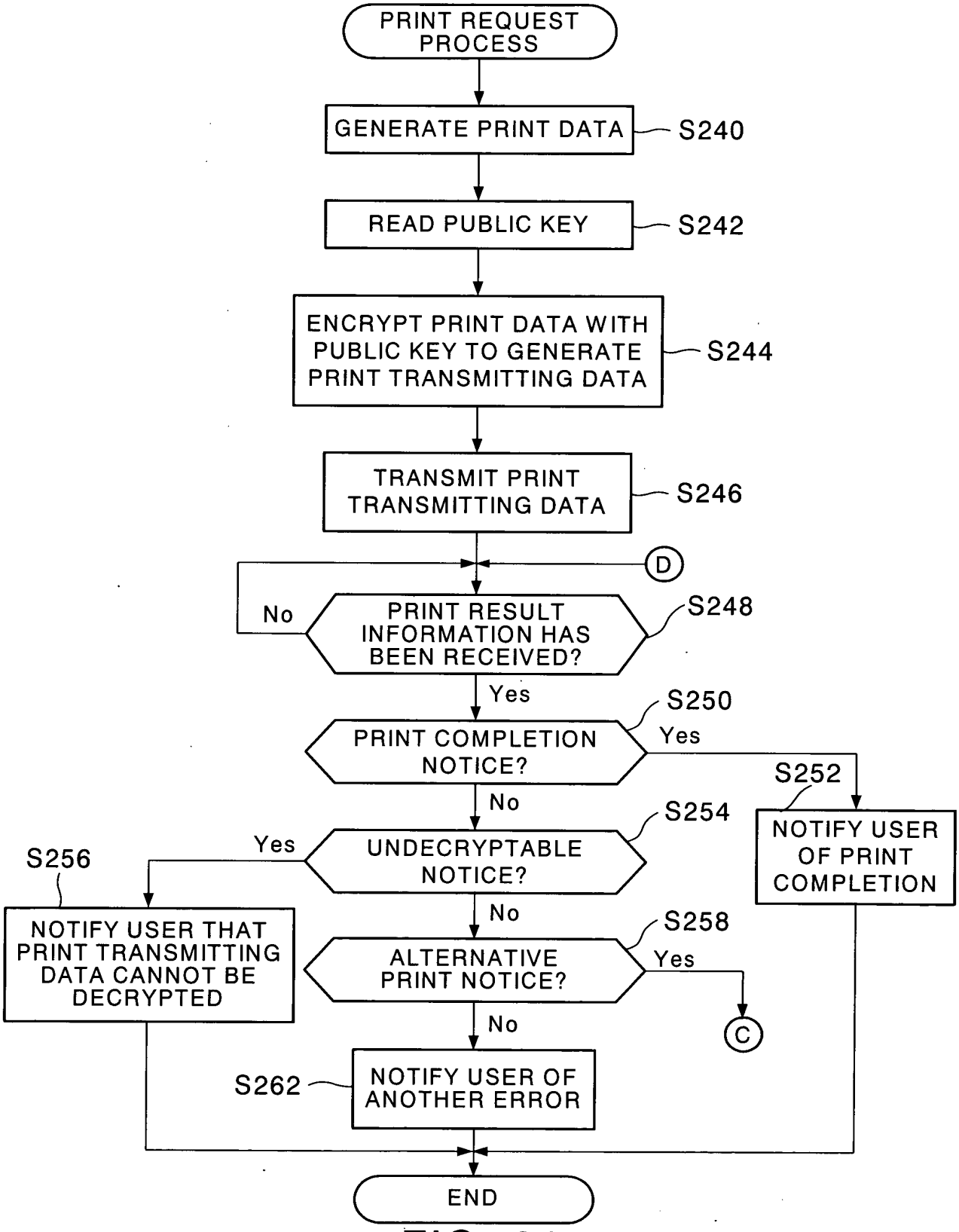
PRINT REQUEST PROCESS
GENERATE PRINT DATA
S240
READ PUBLIC KEY
S242
ENCRYPT PRINT DATA WITH PUBLIC KEY TO GENERATE PRINT TRANSMITTING DATA
S244
TRANSMIT PRINT TRANSMITTING DATA
S246
D
No
PRINT RESULT INFORMATION HAS BEEN RECEIVED?
S248
Yes
PRINT COMPLETION NOTICE?
S250
Yes
S252
NOTIFY USER OF PRINT COMPLETION
No
UNDECRYPTABLE NOTICE?
S254
Yes
S256
NOTIFY USER THAT PRINT TRANSMITTING DATA CANNOT BE DECRYPTED
No
ALTERNATIVE PRINT NOTICE?
S258
Yes
C
No
S262
NOTIFY USER OF ANOTHER ERROR
END

FIG. 21

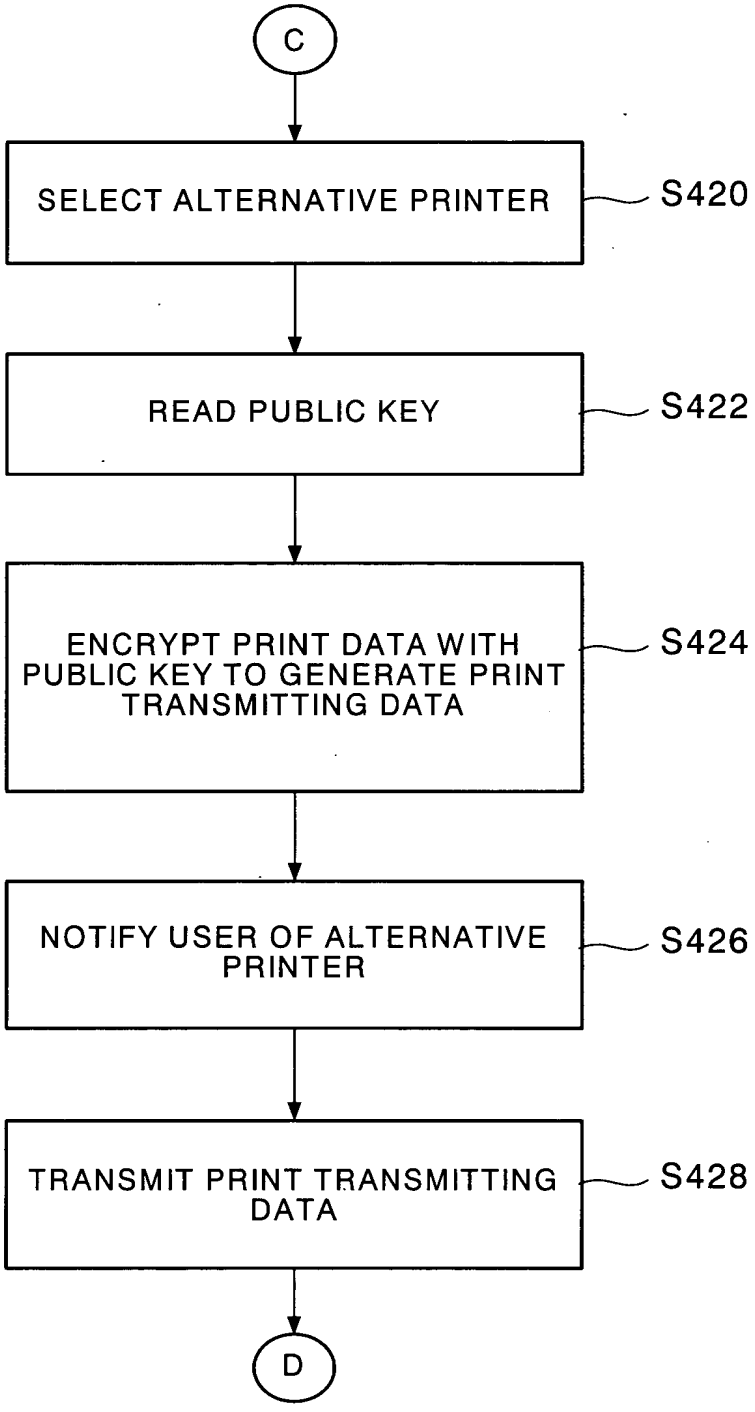
C
SELECT ALTERNATIVE PRINTER
S420
READ PUBLIC KEY
S422
ENCRYPT PRINT DATA WITH PUBLIC KEY TO GENERATE PRINT TRANSMITTING DATA
S424
NOTIFY USER OF ALTERNATIVE PRINTER
S426
TRANSMIT PRINT TRANSMITTING DATA
S428
D

FIG. 22

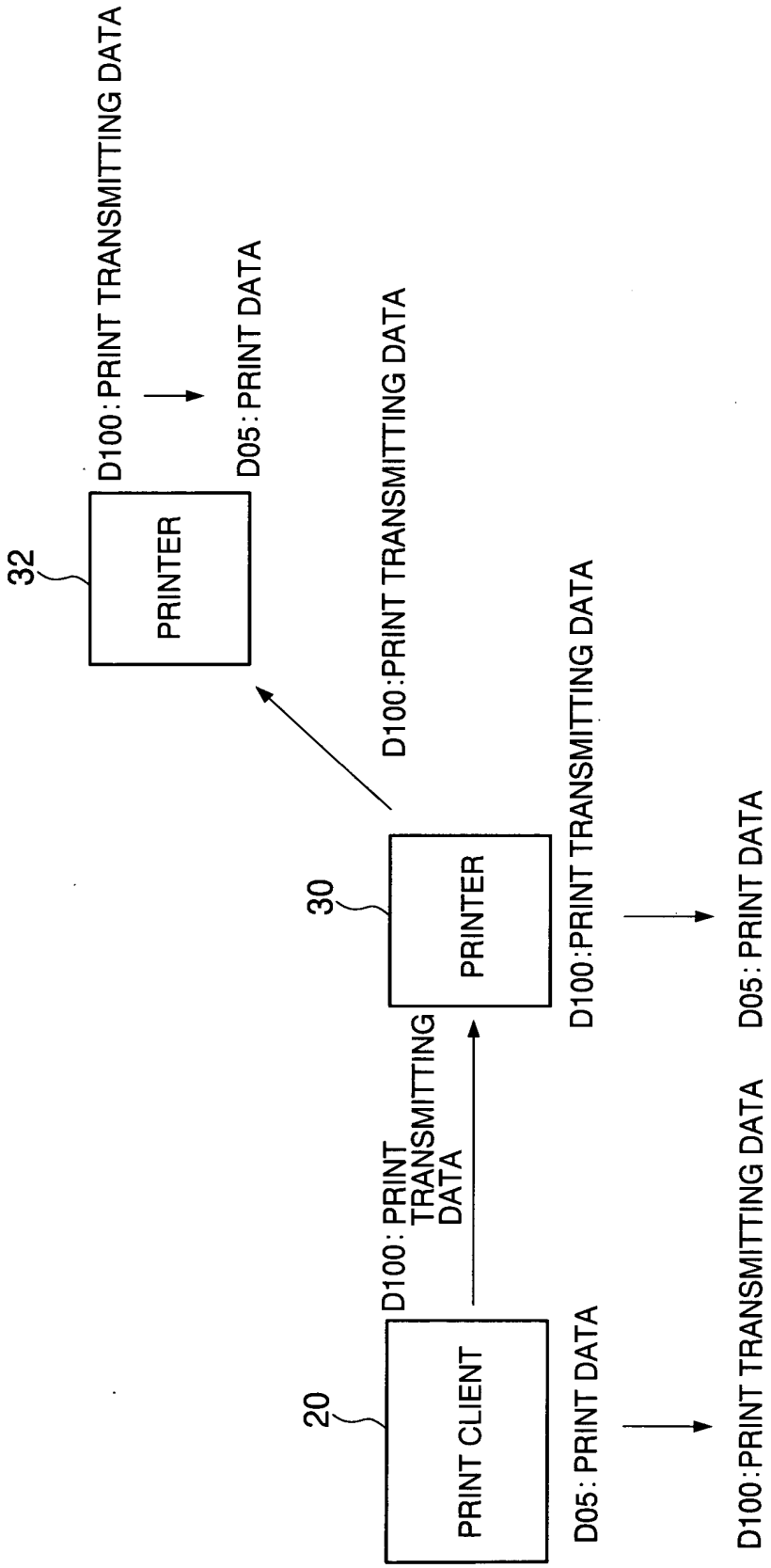
20
PRINT CLIENT
D100: PRINT TRANSMITTING DATA
D05: PRINT DATA
30
PRINTER
D100:PRINT TRANSMITTING DATA
D05: PRINT DATA
D100:PRINT TRANSMITTING DATA
32
PRINTER
D100:PRINT TRANSMITTING DATA
D05: PRINT DATA

FIG. 23

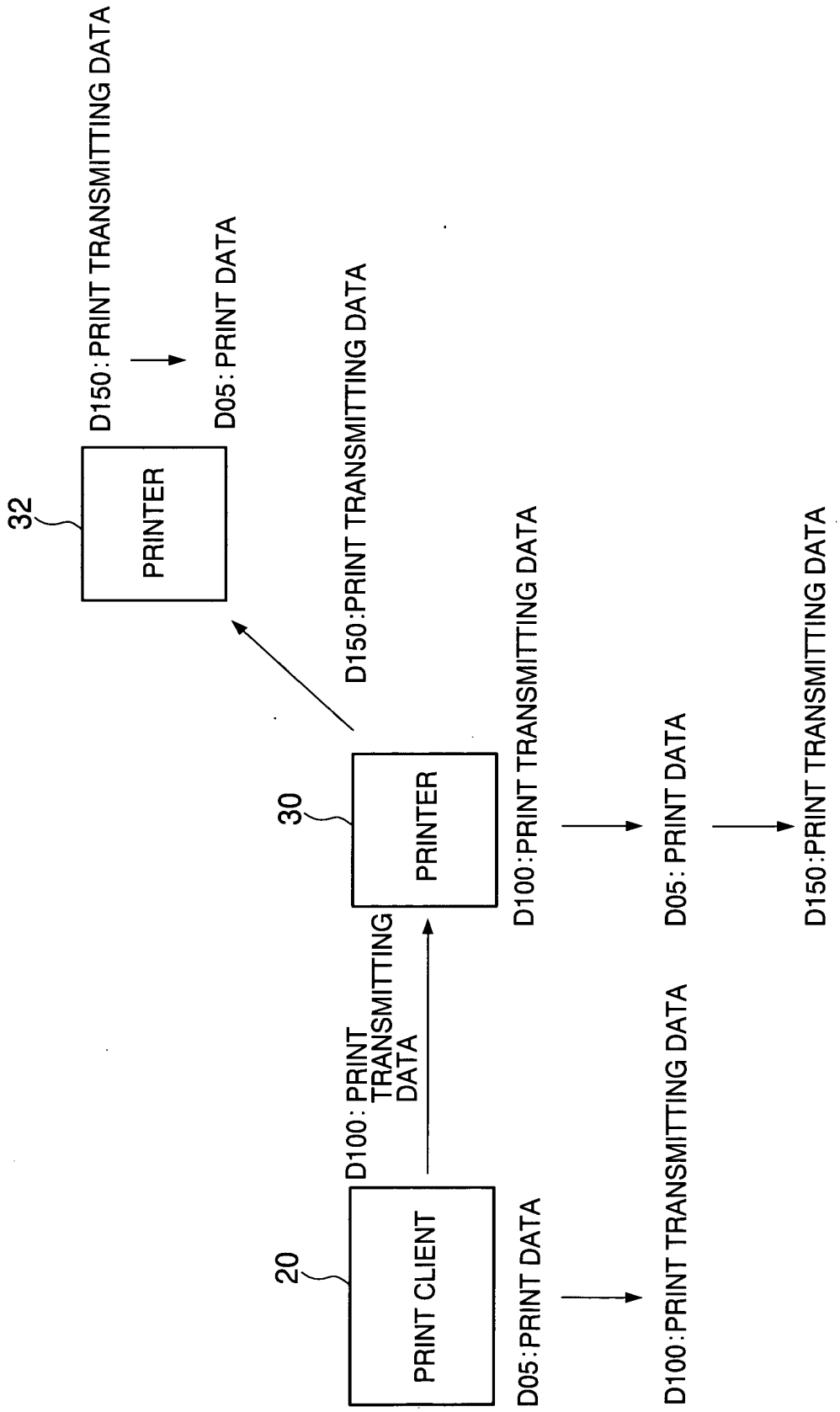
20
PRINT CLIENT
D100: PRINT TRANSMITTING DATA
D05:PRINT DATA
30
PRINTER
D100:PRINT TRANSMITTING DATA
D05: PRINT DATA
D150:PRINT TRANSMITTING DATA
D100:PRINT TRANSMITTING DATA
D05:PRINT DATA
32
PRINTER
D150:PRINT TRANSMITTING DATA
D05: PRINT DATA
D150: PRINT TRANSMITTING DATA

FIG. 24

PRINT TRANSMITTING DATA : D100

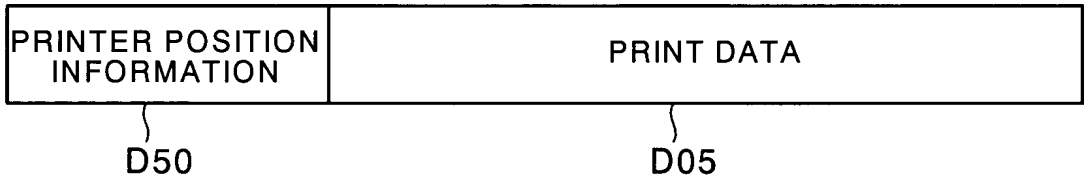

FIG. 25

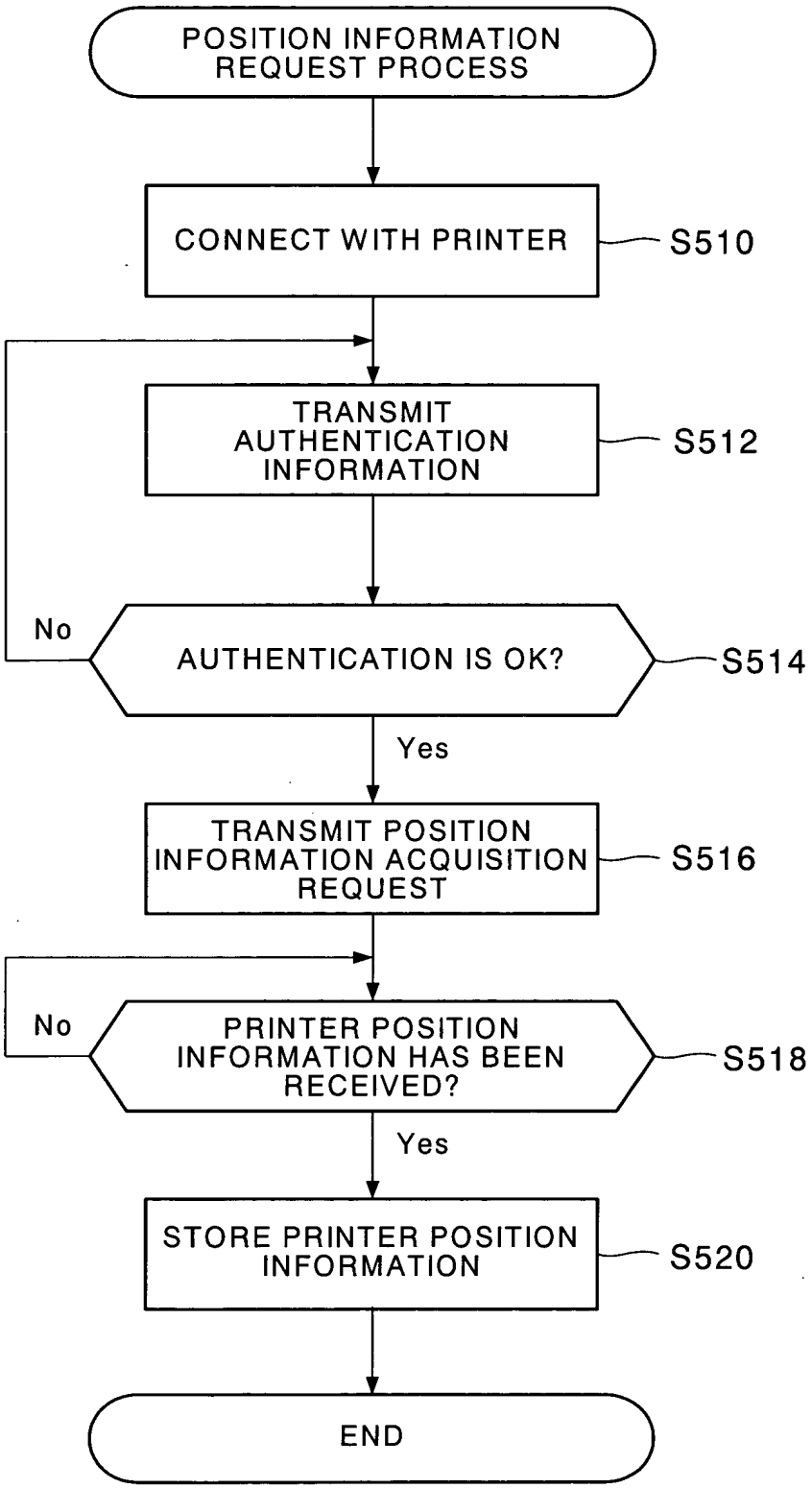
POSITION INFORMATION REQUEST PROCESS
CONNECT WITH PRINTER
S510
TRANSMIT AUTHENTICATION INFORMATION
S512
No
AUTHENTICATION IS OK?
S514
Yes
TRANSMIT POSITION INFORMATION ACQUISITION REQUEST
S516
No
PRINTER POSITION INFORMATION HAS BEEN RECEIVED?
S518
Yes
STORE PRINTER POSITION INFORMATION
S520
END

FIG. 26

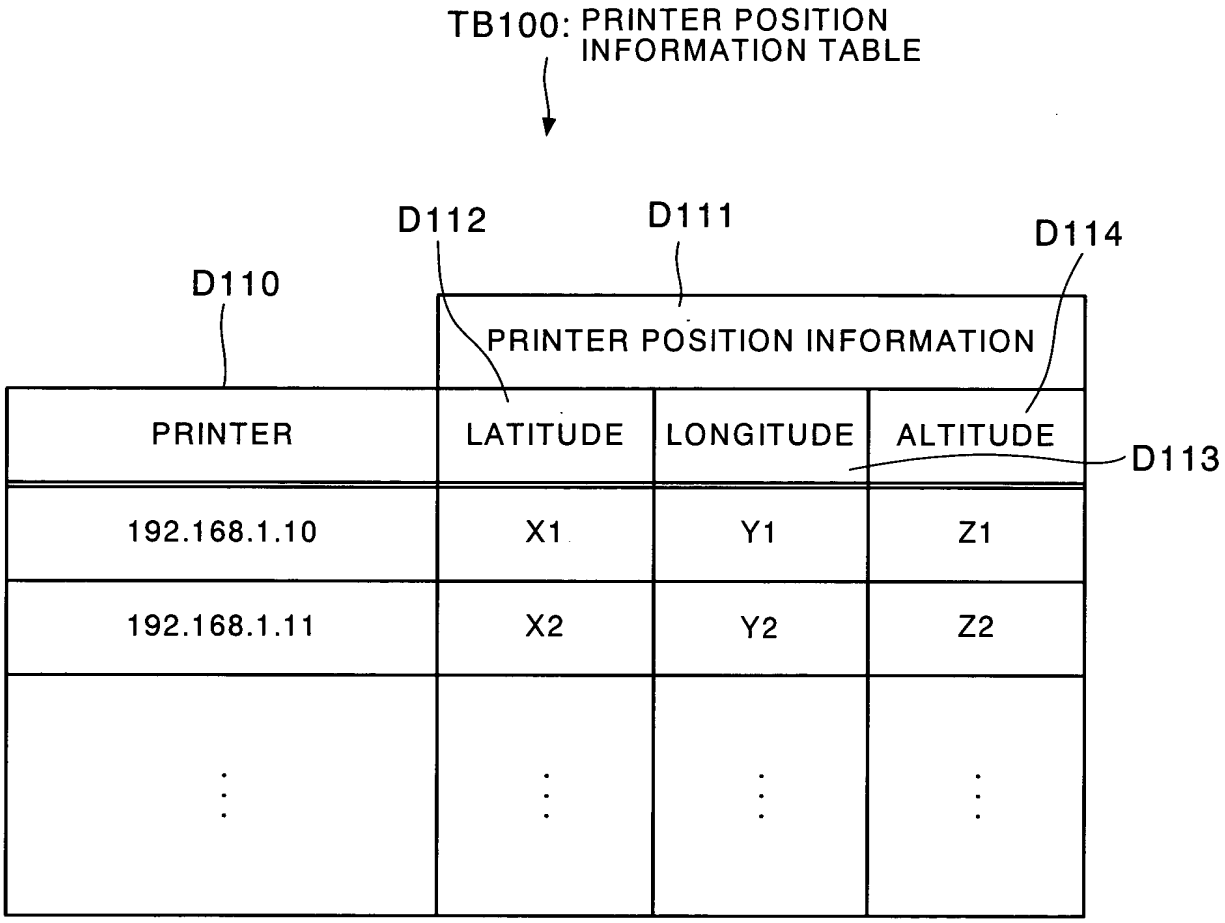
TB100: PRINTER POSITION INFORMATION TABLE
D112
D111
D114
D110
PRINTER POSITION INFORMATION
PRINTER
LATITUDE
LONGITUDE
ALTITUDE
D113
192.168.1.10
X1
Y1
Z1
192.168.1.11
X2
Y2
Z2

FIG. 27

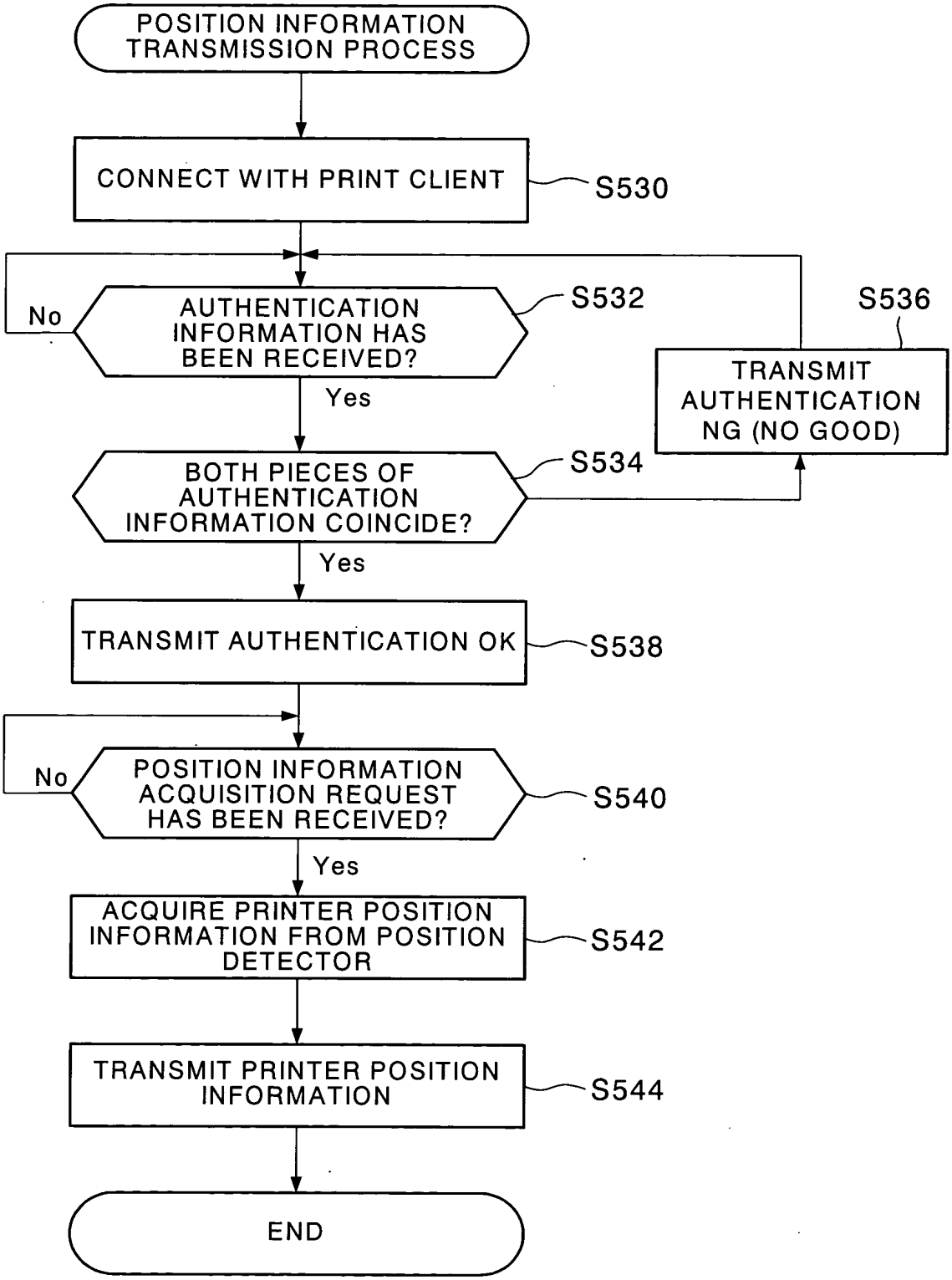
POSITION INFORMATION TRANSMISSION PROCESS
CONNECT WITH PRINT CLIENT
S530
No
AUTHENTICATION INFORMATION HAS BEEN RECEIVED?
S532
Yes
S536
TRANSMIT AUTHENTICATION NG (NO GOOD)
BOTH PIECES OF AUTHENTICATION INFORMATION COINCIDE?
S534
Yes
TRANSMIT AUTHENTICATION OK
S538
No
POSITION INFORMATION ACQUISITION REQUEST HAS BEEN RECEIVED?
S540
Yes
ACQUIRE PRINTER POSITION INFORMATION FROM POSITION DETECTOR
S542
TRANSMIT PRINTER POSITION INFORMATION
S544
END

FIG. 28

TB80: ALTERNATIVE PRINTER LIST TABLE

D40 NETWORK ADDRESS	D41 PRINTER MODEL INFORMATION	D42 RELATIVE DISTANCE	D44 PRINTER POSITION INFORMATION
aaa.bbb.ccc.101	LP-7700	ΔX1, ΔY1, ΔZ1	X1, Y1, Z1
aaa.bbb.ccc.102	LP-8900	ΔX2, ΔY2, ΔZ2	X2, Y2, Z2
aaa.bbb.ccc.103	LP-7700	ΔX3, ΔY3, ΔZ3	X3,Y3, Z3

FIG. 29

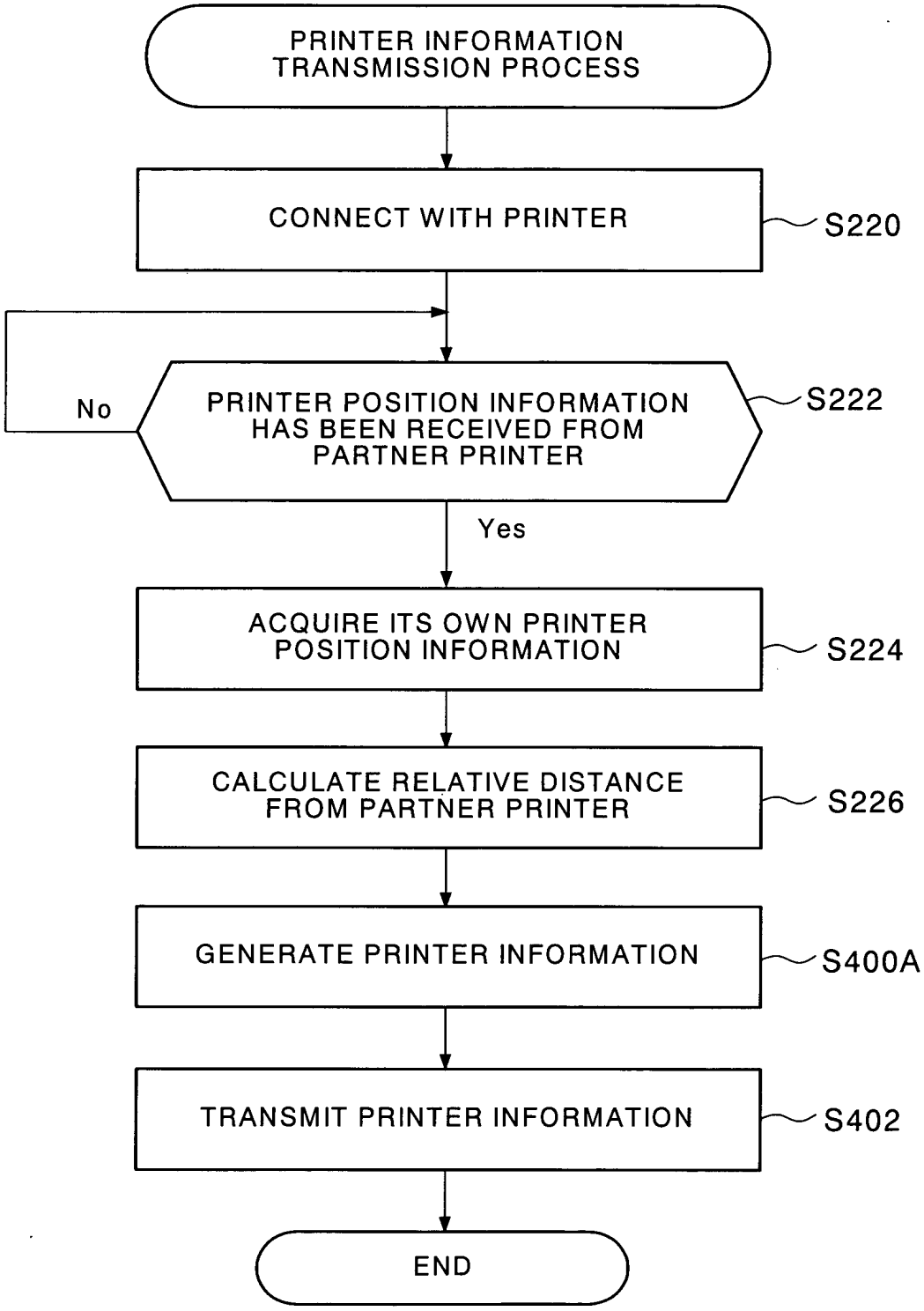
PRINTER INFORMATION TRANSMISSION PROCESS
CONNECT WITH PRINTER
S220
No
PRINTER POSITION INFORMATION HAS BEEN RECEIVED FROM PARTNER PRINTER
S222
Yes
ACQUIRE ITS OWN PRINTER POSITION INFORMATION
S224
CALCULATE RELATIVE DISTANCE FROM PARTNER PRINTER
S226
GENERATE PRINTER INFORMATION
S400A
TRANSMIT PRINTER INFORMATION
S402
END

FIG. 30

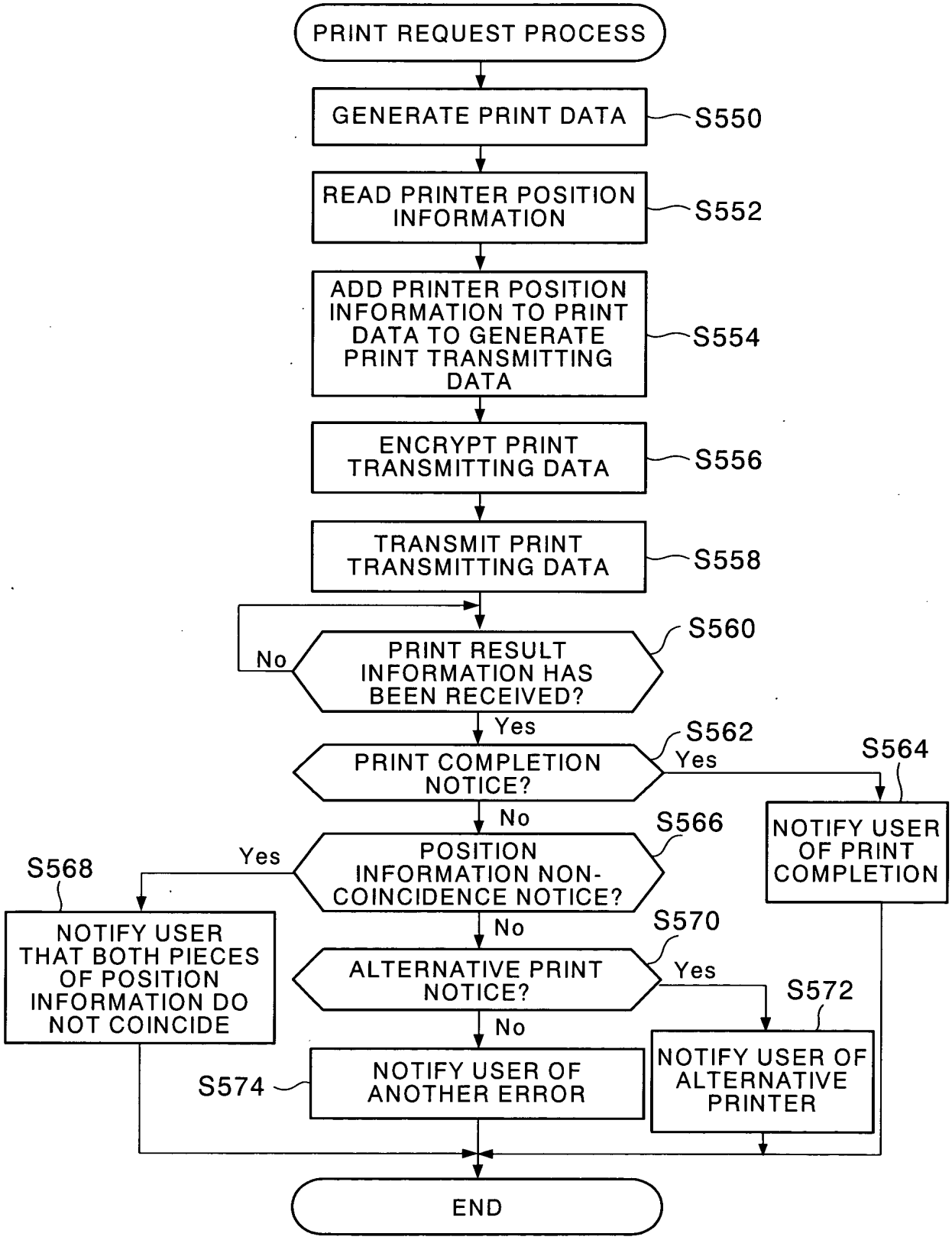
PRINT REQUEST PROCESS
GENERATE PRINT DATA
S550
READ PRINTER POSITION INFORMATION
S552
ADD PRINTER POSITION INFORMATION TO PRINT DATA TO GENERATE PRINT TRANSMITTING DATA
S554
ENCRYPT PRINT TRANSMITTING DATA
S556
TRANSMIT PRINT TRANSMITTING DATA
S558
S560
No
PRINT RESULT INFORMATION HAS BEEN RECEIVED?
Yes
S562
PRINT COMPLETION NOTICE?
Yes
S564
NOTIFY USER OF PRINT COMPLETION
No
S566
Yes
S568
POSITION INFORMATION NON-COINCIDENCE NOTICE?
NOTIFY USER THAT BOTH PIECES OF POSITION INFORMATION DO NOT COINCIDE
No
S570
ALTERNATIVE PRINT NOTICE?
Yes
S572
No
NOTIFY USER OF ALTERNATIVE PRINTER
S574
NOTIFY USER OF ANOTHER ERROR
END

FIG. 31

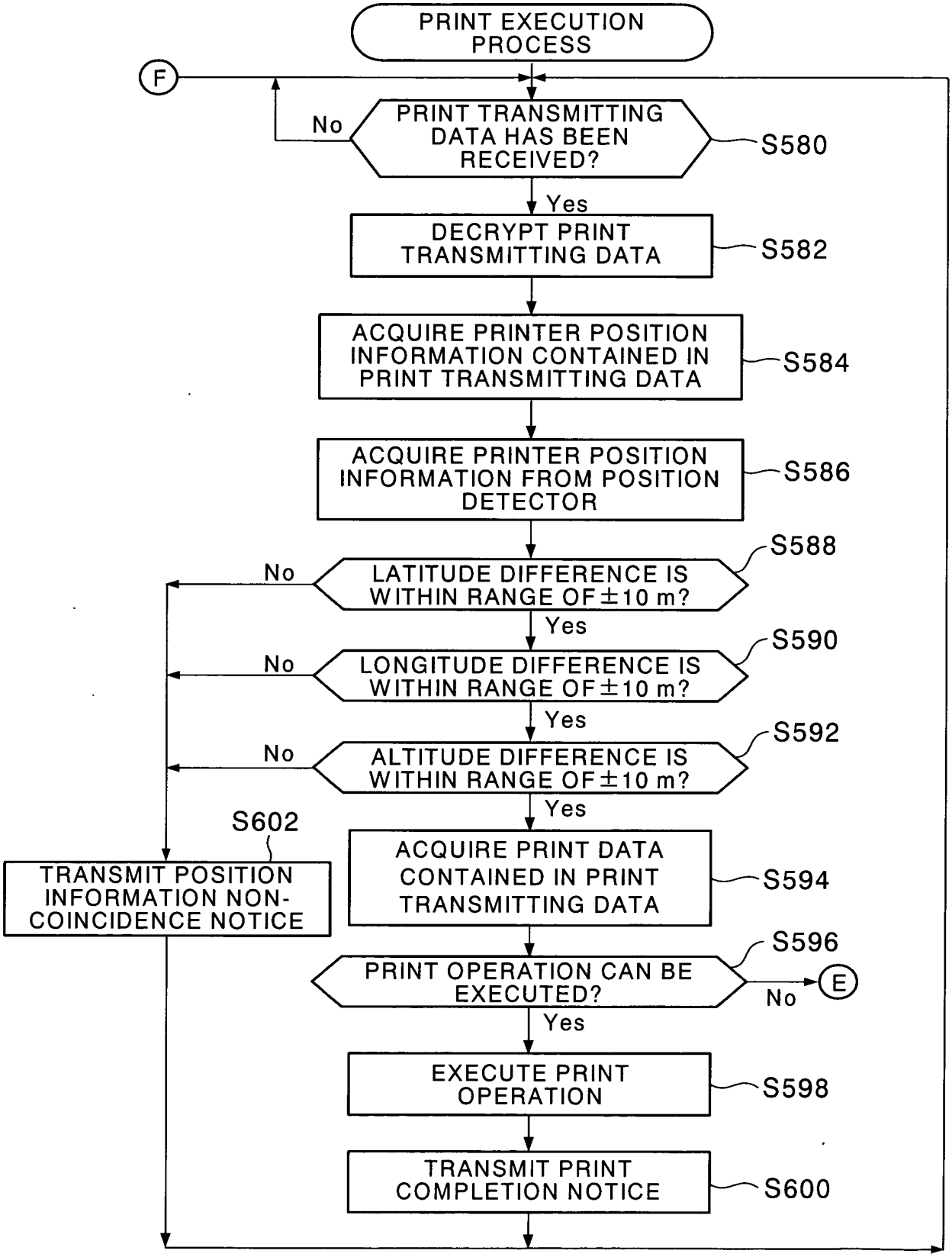
PRINT EXECUTION PROCESS
F
No
PRINT TRANSMITTING DATA HAS BEEN RECEIVED?
S580
Yes
DECRYPT PRINT TRANSMITTING DATA
S582
ACQUIRE PRINTER POSITION INFORMATION CONTAINED IN PRINT TRANSMITTING DATA
S584
ACQUIRE PRINTER POSITION INFORMATION FROM POSITION DETECTOR
S586
S588
No
LATITUDE DIFFERENCE IS WITHIN RANGE OF ±10 m?
Yes
S590
No
LONGITUDE DIFFERENCE IS WITHIN RANGE OF ±10 m?
Yes
S592
No
ALTITUDE DIFFERENCE IS WITHIN RANGE OF ±10 m?
Yes
S602
TRANSMIT POSITION INFORMATION NON-COINCIDENCE NOTICE
ACQUIRE PRINT DATA CONTAINED IN PRINT TRANSMITTING DATA
S594
S596
PRINT OPERATION CAN BE EXECUTED?
No
E
Yes
EXECUTE PRINT OPERATION
S598
TRANSMIT PRINT COMPLETION NOTICE
S600

FIG. 32

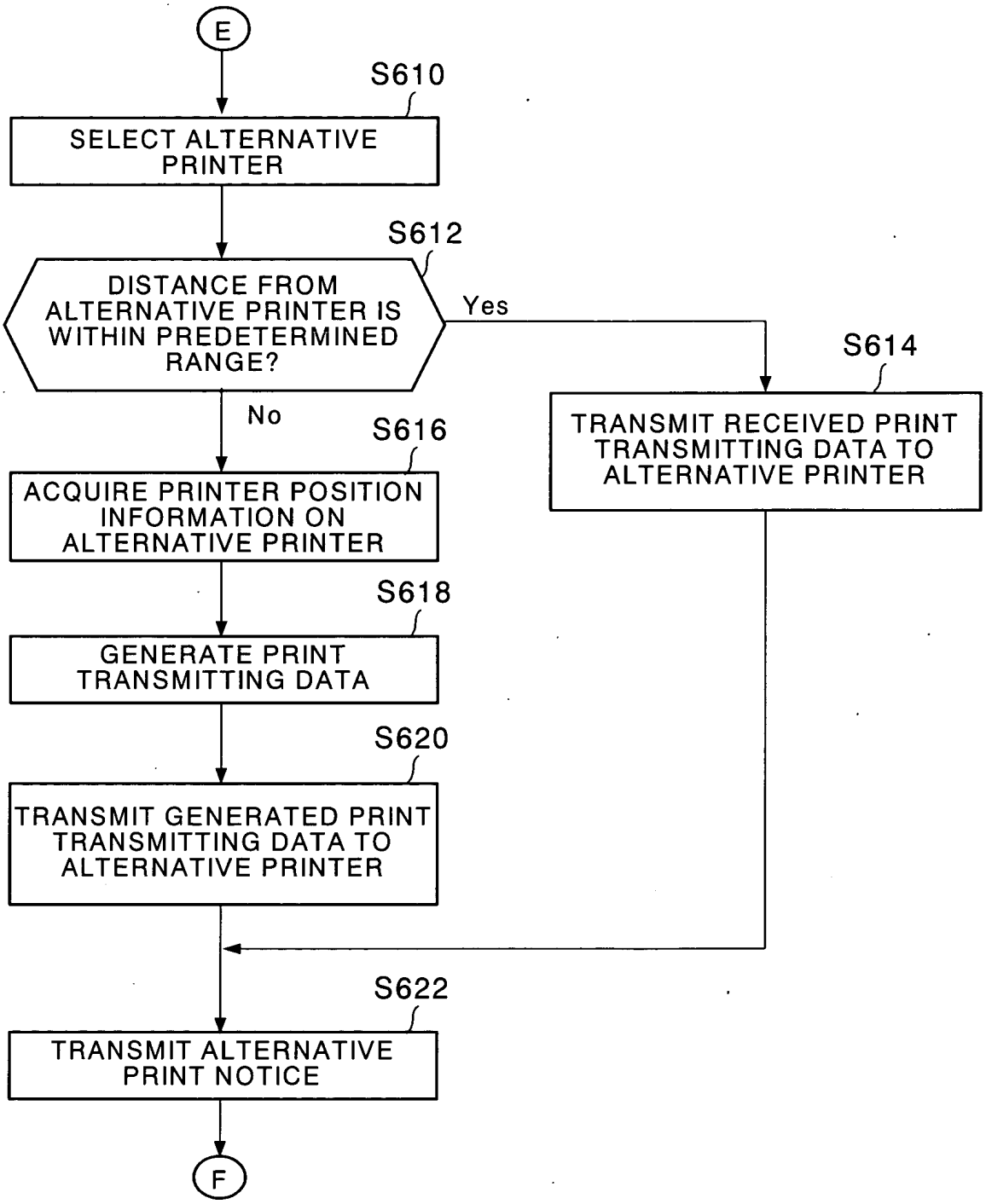
E
S610
SELECT ALTERNATIVE PRINTER
S612
DISTANCE FROM ALTERNATIVE PRINTER IS WITHIN PREDETERMINED RANGE?
Yes
No
S614
TRANSMIT RECEIVED PRINT TRANSMITTING DATA TO ALTERNATIVE PRINTER
S616
ACQUIRE PRINTER POSITION INFORMATION ON ALTERNATIVE PRINTER
S618
GENERATE PRINT TRANSMITTING DATA
S620
TRANSMIT GENERATED PRINT TRANSMITTING DATA TO ALTERNATIVE PRINTER
S622
TRANSMIT ALTERNATIVE PRINT NOTICE
F

FIG. 33

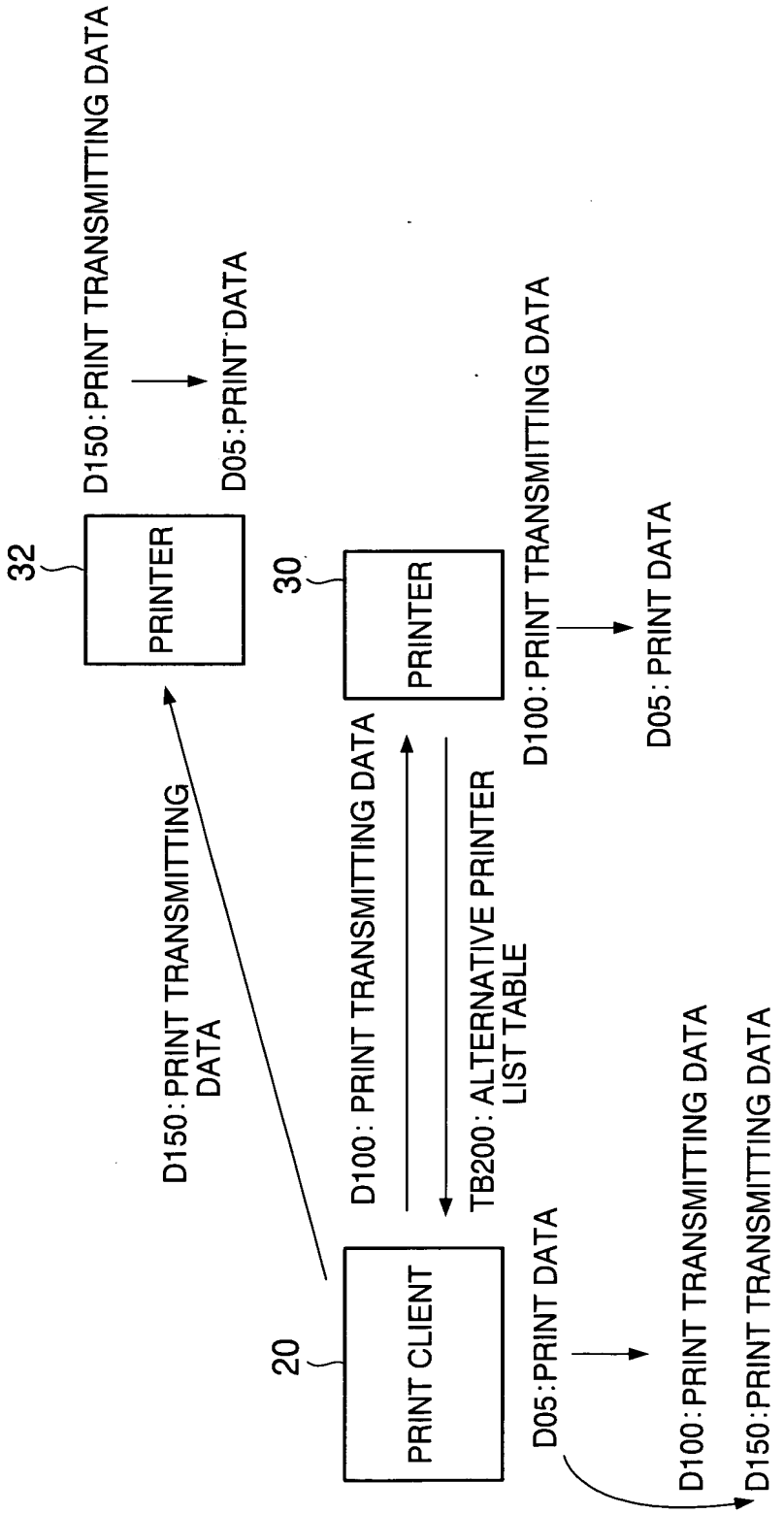
D150:PRINT TRANSMITTING DATA
D05:PRINT DATA
32
PRINTER
30
PRINTER
D150:PRINT TRANSMITTING DATA
D100:PRINT TRANSMITTING DATA
D05:PRINT DATA
D100: PRINT TRANSMITTING DATA
TB200: ALTERNATIVE PRINTER LIST TABLE
20
PRINT CLIENT
D05:PRINT DATA
D100:PRINT TRANSMITTING DATA
D150:PRINT TRANSMITTING DATA

FIG. 34

TB200 : ALTERNATIVE PRINTER LIST TABLE

D40 NETWORK ADDRESS	D41 PRINTER MODEL INFORMATION	D42 RELATIVE DISTANCE
aaa.bbb.ccc.101	LP-7700	ΔX1, ΔY1, ΔZ1
aaa.bbb.ccc.102	LP-8900	ΔX2, ΔY2, ΔZ2
aaa.bbb.ccc.103	LP-7700	ΔX3, ΔY3, ΔZ3

FIG. 35

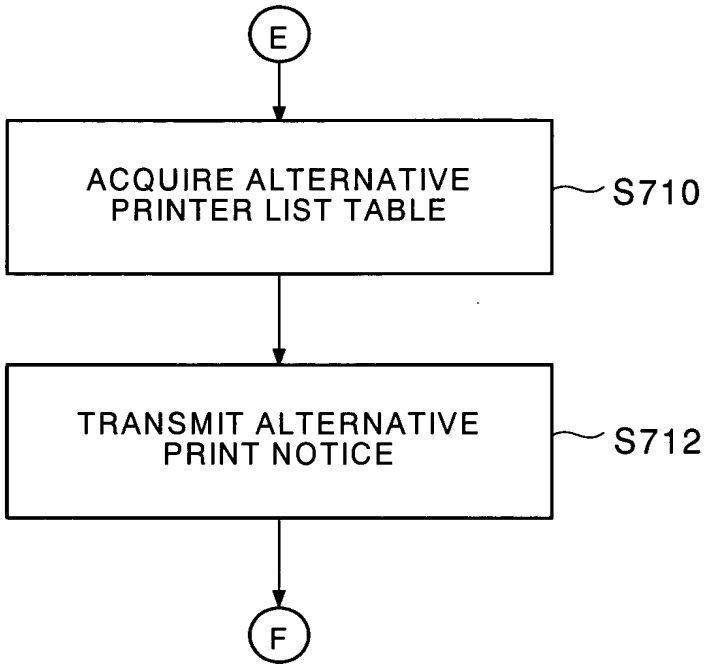
E
ACQUIRE ALTERNATIVE PRINTER LIST TABLE
S710
TRANSMIT ALTERNATIVE PRINT NOTICE
S712
F

FIG. 36

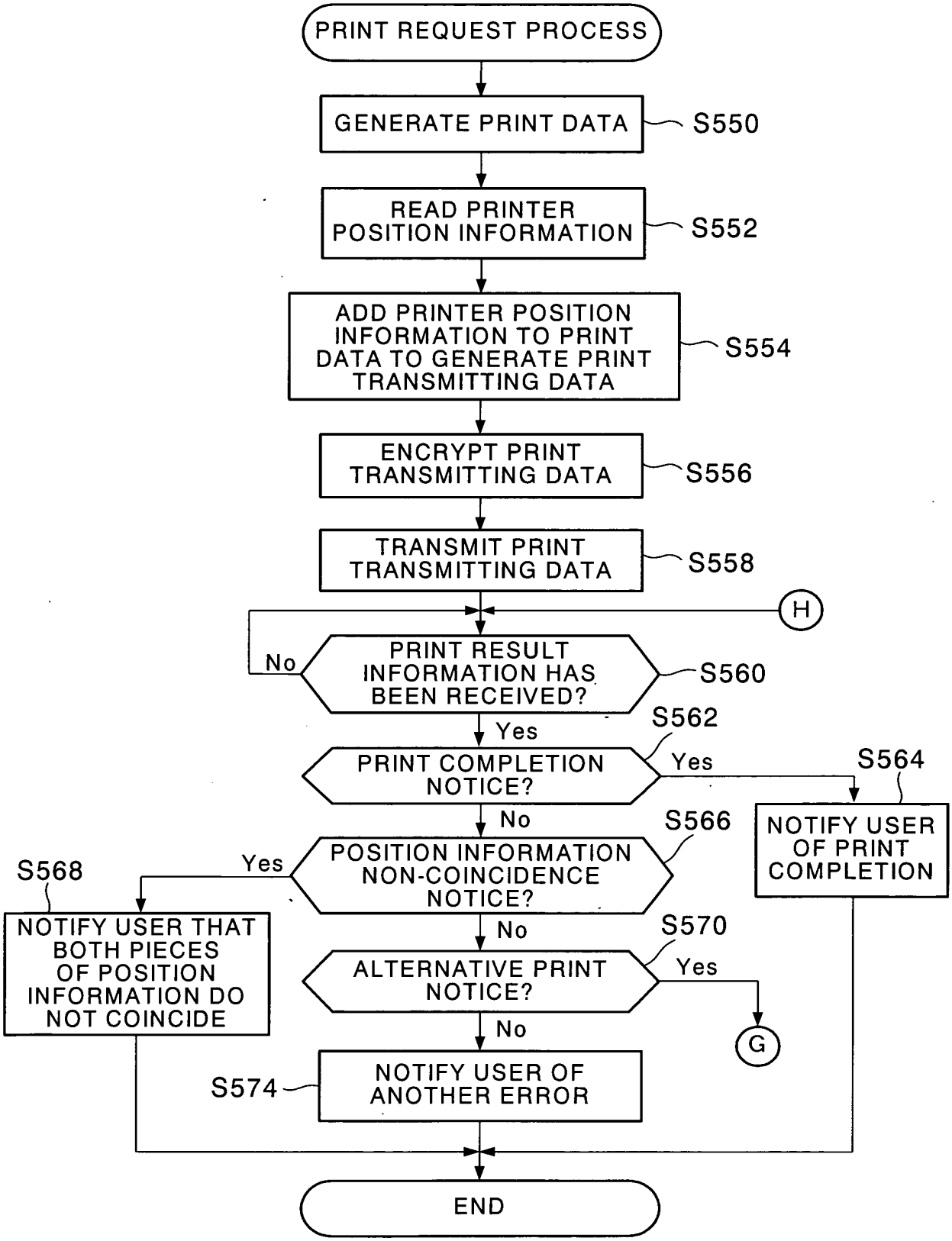
PRINT REQUEST PROCESS
GENERATE PRINT DATA
S550
READ PRINTER POSITION INFORMATION
S552
ADD PRINTER POSITION INFORMATION TO PRINT DATA TO GENERATE PRINT TRANSMITTING DATA
S554
ENCRYPT PRINT TRANSMITTING DATA
S556
TRANSMIT PRINT TRANSMITTING DATA
S558
H
No
PRINT RESULT INFORMATION HAS BEEN RECEIVED?
S560
Yes
S562
PRINT COMPLETION NOTICE?
Yes
S564
NOTIFY USER OF PRINT COMPLETION
No
S566
POSITION INFORMATION NON-COINCIDENCE NOTICE?
Yes
S568
NOTIFY USER THAT BOTH PIECES OF POSITION INFORMATION DO NOT COINCIDE
No
S570
ALTERNATIVE PRINT NOTICE?
Yes
G
No
S574
NOTIFY USER OF ANOTHER ERROR
END

FIG. 37

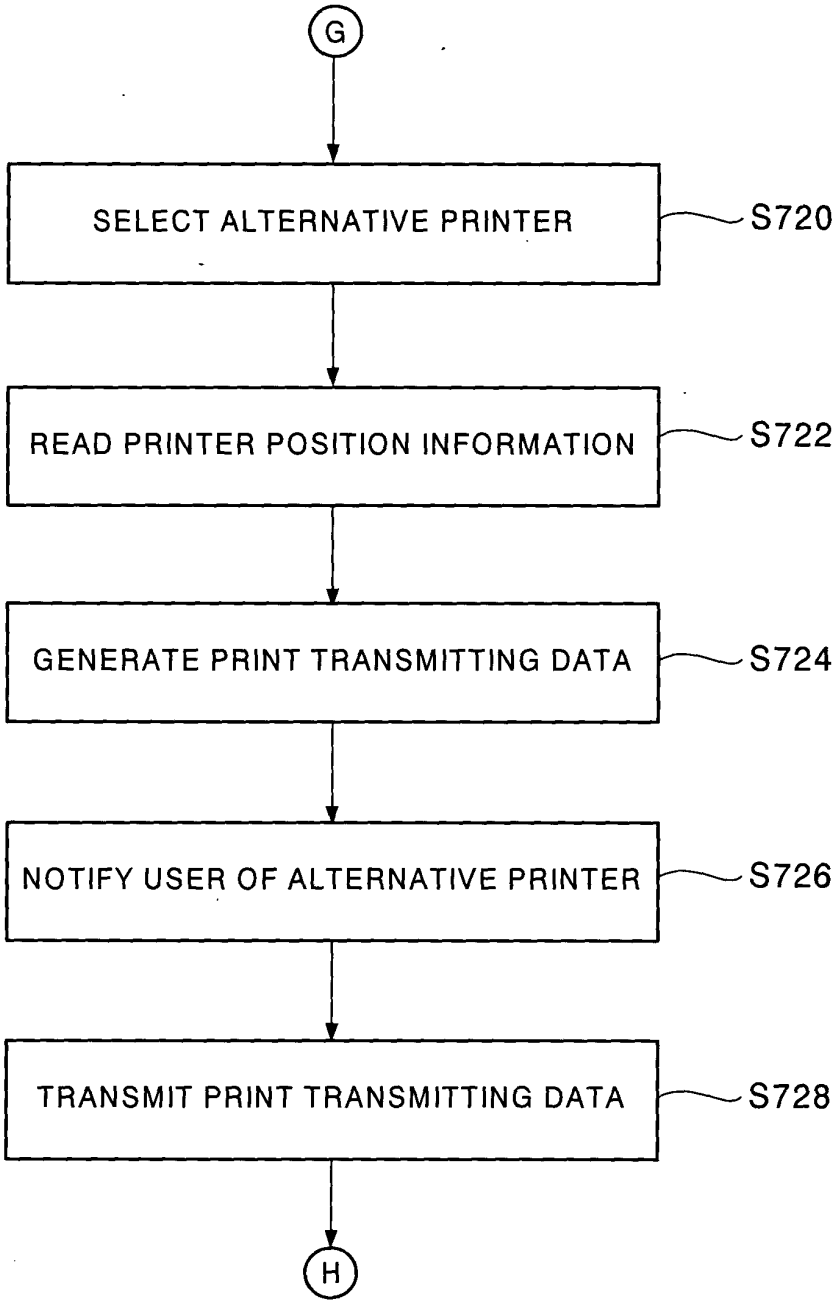
G
SELECT ALTERNATIVE PRINTER
S720
READ PRINTER POSITION INFORMATION
S722
GENERATE PRINT TRANSMITTING DATA
S724
NOTIFY USER OF ALTERNATIVE PRINTER
S726
TRANSMIT PRINT TRANSMITTING DATA
S728
H

FIG. 38

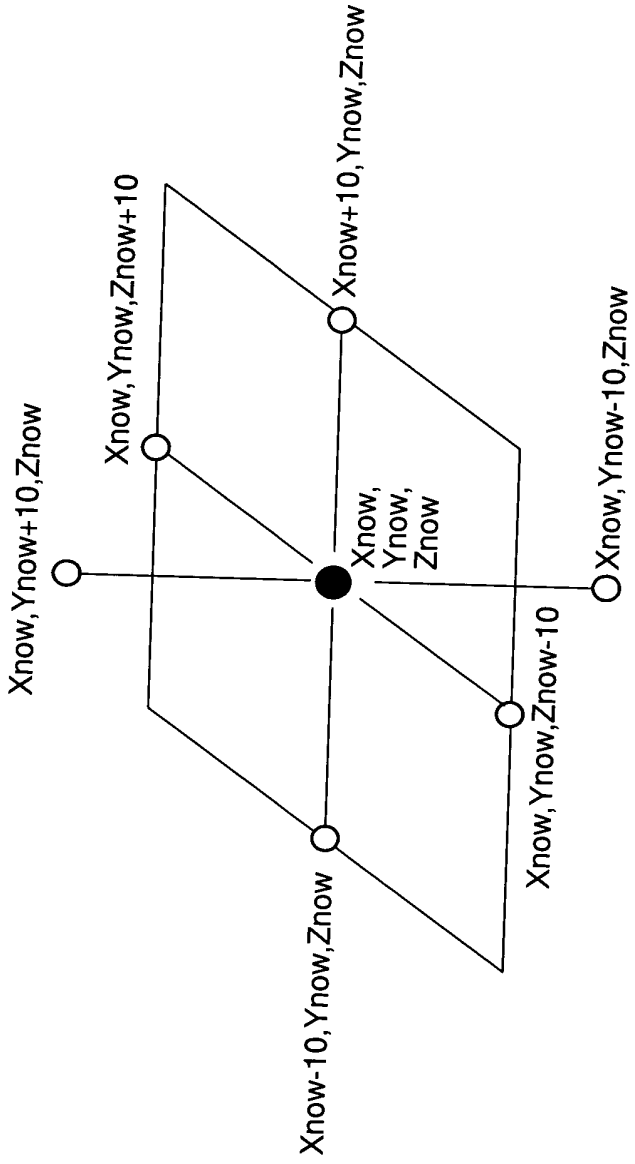
Xnow,Ynow+10,Znow
Xnow,Ynow,Znow+10
Xnow+10,Ynow,Znow
Xnow,
Ynow,
Znow
Xnow,Ynow-10,Znow
Xnow,Ynow,Znow-10
Xnow-10,Ynow,Znow
Y
Z
X

FIG. 39